PUBLIC HEALTH

REPORTS AND PAPERS

VOLUME II

PRESENTED AT THE MEETINGS OF THE

American Public Health Association

IN THE YEARS

1874–1875

WITH AN ABSTRACT OF THE RECORD OF PROCEEDINGS
1872–1875

NEW YORK
PUBLISHED BY HURD AND HOUGHTON
The Riverside Press, Cambridge
1876

RIVERSIDE, CAMBRIDGE:
PRINTED BY H. O. HOUGHTON AND COMPANY.

CONTENTS.

DIVISION OF SUBJECTS.

INDEX OF TOPICS.

I. PUBLIC HEALTH CARE AND GENERAL PHYSICAL CONDITIONS RELATING TO HYGIENE.

II. EDUCATIONAL AND PHYSIOLOGICAL SUBJECTS AFFECTING HEALTH.

III. SANITARY ENGINEERING: DRAINAGE, SEWERAGE, CLEANSING.

IV. HOSPITALS. — SANITARY CARE OF CONTAGIOUS AND INFECTIOUS DISEASES.

V. REPORTS UPON YELLOW FEVER.

VI. PUBLIC HEALTH LAWS AND SANITARY ADMINISTRATION.

INTRODUCTORY NOTE.

By the Secretary of the Association.

THE American Public Health Association entered on the fourth year of its existence with a greater number of written contributions from its members than could be published in its second volume of Transactions. The Publishing Committee, which was appointed at the third annual meeting, has therefore placed in this volume as many of the reports and papers of 1874 and 1875 as practicable, selecting those which deserved early publication, and securing in them as great a degree of condensation as possible. An abstract of all proceedings and minutes of the successive meetings of the Association, from its organization in 1872 to the close of its third year, is also published in this volume, as directed by the Executive Committee.

Several papers necessarily omitted from this volume, though arranged to be published in it, may be issued in the succeeding one. Numerous other contributions received at the annual meetings, have been given to the scientific journals, while others still are being used in the prosecution of further observation and study by the authors. The effectual utilization of all the reports and papers contributed by members of the Association is thus secured; and it is believed that with the present increasing care in preparing reports and contributions, and the growing demand for such sanitary publications, the transactions of the Association will henceforth be issued soon after each annual meeting.

The widely extended interest in public health questions, the tendency to sanitary organization, and to various works for the improvement of public health of cities and large towns, the recognition of inevitable but hitherto neglected relations of hygiene to social progress and human welfare, and the necessity which is now felt for sound legislation and the organization of competent sources of advice and authority relating to the protection of the public health in the several States, called this Association into existence and now govern its policy. These causes have also commanded for this body the generous support of representative men in the various departments of learning and experience by which sanitary science and the public health service are promoted. The wide range of subjects for investigation and development, and the necessity for concerted study and conference by experienced and well-informed observers who contribute to sanitary progress, have been abundantly witnessed in the reports and papers presented in successive meetings, as well as in the cordial support of this Association. It has become a National Association by virtue of the national importance of the

sanitary knowledge and improvements which it promotes. State Boards of Health, hygienic observations and studies, the necessity for sound laws and methods of administration in all matters affecting the protection of life and health, and the necessity for centrally organized and harmonious methods of inquiry and action concerning exotic and contagious diseases, must eventually call into existence a national conference of sanitary officers ; yet, while urging such progress in public health duties, this Association has an ample field for the voluntary work which its members have undertaken.

Public health is now well understood to imply so many attendant conditions of physical and social welfare which alike depend upon it and yet increase and protect it, and so greatly also to affect the destiny of nations, that the influence of all well directed endeavors for promoting sanitary knowledge and its applications takes hold upon the highest interests of mankind. Individuals may sicken and be prematurely cut off, families may degenerate and perish by their own acquired and entailed disabilities and diseases, even a great city may be decimated by pestilence, and all such misfortunes be turned to account for the general saving of life in a great country, but a sickly, enfeebled, and degenerate condition of the people throughout the republic, would presage the decay, and impending death of the nation. The strength of a nation consists primarily in the health and virtues of the people. The highest patriotism, prosperity, and noblest virtues flourish in such exact and dependent relations to bodily health and sanitary welfare, that the promotion and general safe-guarding of the public health, will, in the advancing civilization and higher culture of communities, become more and more a matter of prevision and organized care and administration. The pernicious effects of malaria in the deterioration of health and wasting of life, the agency of civic filth and domestic uncleanliness in fostering and giving fatal force to infectious and epidemic maladies, the deadly effects of defilement of water-supplies, the hurtful qualities of diseased or vitiated food-supplies, the neglect of market-places, the perilous condition of certain classes of school-rooms and other places of public assemblage, the massing of the families of the poor in crowded tenement houses, the neglect and consequent increase of diseased and degraded classes, and the failure to deal with diseases and their causes as foes of individuals and of society, will, so long as they continue, incite to ceaseless efforts for the prevention of these evils, and give practical direction to such voluntary work as this Association is doing. While thus laboring to promote the health and prosperity of the people there is ever in view a still greater ultimate benefit to mankind ; for the relations of health to the higher culture, so eloquently set forth in one of the discourses in this volume, must be regarded as the most enduring and important of the relations of hygiene and the public health service. As one of the greatest masters in this field of labors in England has recently said, "There is a Divine image in the future to which the nation must aspire. The first step towards it, is to improve the health of the present generation."

I.

PUBLIC HEALTH CARE AND GENERAL PHYSICAL CONDITIONS RELATING TO HYGIENE.

A VIEW OF SOME OF THE LEADING PUBLIC HEALTH QUESTIONS IN THE UNITED STATES.

INTRODUCTORY ADDRESS BEFORE THE AMERICAN PUBLIC HEALTH ASSOCIATION AT ITS THIRD ANNUAL MEETING. BALTIMORE, NOVEMBER 9, 1875.

By JOSEPH M. TONER, M. D.,
President of the Association.

TO-DAY we open the Third Annual Meeting of the American Public Health Association, although in fact, it is the sixth meeting of its friends.[1]

I congratulate you on the large attendance of members from all parts of our country, as well as upon the evidences we receive from every source, of the great interest which the public are taking in our labors. This movement for the prevention of disease has enlisted in its cause not only the medical but also the clerical profession, as well as scientific and thinking men of all classes. In the interest of the great purposes of this Association, I welcome all present to our deliberations, whether members of this body or not. This occasion does not require of me to enlarge on either the history or importance of State Medicine. The one is well known and the other is generally admitted ; but while the intelligent citizen recognizes his duty, the full obligation of the Government, State and National, to protect the public health, has neither been assumed nor generally conceded by our law-makers. This trust on the part of governments is beginning to be better understood, and I am confident future legislations will supply the omission and correct the errors of the past.[2] I will, therefore, take this occa-

[1] The preliminary meeting which led to the organization of the American Public Health Association was held in New York, April 18, 1872.

The Committee then appointed to perfect a plan for organization, called a second meeting at Long Branch, N. J., September 12, 1872, at which a constitution was adopted and officers elected. The third meeting convened at Cincinnati, Ohio, May 1, 1873. The fourth meeting was held in New York, November 11, 1873. The fifth meeting was held in the city of Philadelphia, November 10–12, 1874.

[2] The following very just remarks were made by Dr. Benjamin Rush in his inquiry into the *Sources of Summer and Autumnal Fevers of the United States* (vol. iv. p. 139) : —

"To every natural evil, the Author of Nature has kindly prepared an antidote. Pestilential fevers furnish no exception to this remark. The means of preventing them are as much under the power of human reason and industry as preventing the evils of lightning

sion, which courtesy has assigned me, for presenting some views on sanitary measures, which I conceive to be important and of general interest to the whole country, premising that the transactions at our meetings have not an exclusively scientific purpose, nor are they designed to give systematic instruction in hygiene. We fully recognize, however, the fact, that efficient sanitary work requires the aid of both science and art, and while giving every attention to these, we further aim by affording information upon matters of sanitary relations to assist in educating the public mind to an appreciation of the importance of preventive medicine. It is also within our province to encourage the organization of State and local boards of health having a uniform nomenclature of diseases and systematic methods of registration of vital statistics.

We hope to see the purposes of this Association and the study of hygiene receive the active support of all intelligent men; and we trust its labors and publications may encourage the discussion of preventive medicine in every locality, and foster a disposition to observe and note the causes that deteriorate, or in any way affect the public health. Our mission is to impart and encourage throughout the United States correct views on all that relates to man's physical well-being. In the language of Dr. Parkes, hygiene aims at "rendering growth more perfect, decay less rapid, life more vigorous, and death more remote." Sanitary science, in its application to the necessities of modern society for the preservation of health, constitutes one of the most important advances and reforms of this or of any age. I am convinced that there is no subject of greater importance and interest to the people than that of the cleanliness of cities and towns, and the careful investigation of the causes of disease. A matter so vital to the welfare of the inhabitants cannot be safely ignored by the authorities of a state or nation; scientific investigation and appropriate legislation must be had.

The masses should be taught to understand that filth and the neglect of hygienic precautions enfeeble health, breed disease, encourage vice, and shorten life. The sanitary policing of cities thus becomes an imperative necessity. Experience teaches all who investigate the possibilities of preventive medicine, how utterly indifferent the body of the people are to conditions that deteriorate health, and how certainly the ignorant will throw obstacles in the way of public officers in the execution of even the simplest sanitary regulations. In our efforts for reform, we should remember that the time is not remote when diseases were believed to be direct visitations of Divine Providence, and when it was deemed impious to attempt to avert their consequences. Indeed, this view is still held by ignorant and superstitious people in different parts of the world.[1]

Besides this, there exists with many a false conception of personal and domiciliary rights. The power to do, to neglect, and to maintain — upon their own premises — whatever their cupidity, their ignorance and debasing

and common fire. I am so satisfied of the truth of this opinion, that I look for a time when our courts of law shall punish cities and villages for permitting any of the sources of bilious and malignant fevers to exist within their jurisdiction."

[1] This was recently exhibited in Canada in the riotous proceedings against general vaccination.

habits or laziness may elect, without molestation and without question, by neighbors or the municipal authorities, is everywhere arrogated by the uneducated, and this assumption has greatly retarded the progress and efficiency of State Medicine. To what extent, during past ages, the ruling classes were responsible for the very general neglect of civic cleanliness among the helpless and ignorant, and the prevalence of the belief that all man's ills were due to an avenging Providence, I am not prepared to say. The general diffusion of knowledge in the present age, the consequent wonderful advance in personal freedom, liberty of opinion, and the demand of all to have a voice in framing laws, — laws which are to bear equally upon every individual, and are to work in consonance with the wants of an advancing civilization, — justify us in assuming that intelligence has been nearly emancipated from that intolerant, dogmatic authority which has been the outgrowth of superstitious ignorance and arrogant misrule. It is indeed an encouraging evidence in confirmation of the assumed increase of information among the people, that multitudes in every community now accept the doctrine that many diseases are preventable. I am persuaded the number is rapidly augmenting in all classes of society, who fully believe in the ability of the chemist and microscopist to detect adulterations and poisons in food, and discover organic and other deleterious matters in drinking-water. This fact, simple as it is, is a triumph of science, and strikes the unlettered with amazement. When once the mind is convinced that science can detect poisons in water and articles of diet, — however minutely disseminated, — it becomes an easy matter for it to accept the additional fact, that sanitary inspectors can discover in the want of cleanliness and the accumulation of filth, in and around dwellings and badly-ventilated tenements, conditions which not only taint the air with their emanations, but penetrate the clothing, furniture, and food, destroy health, and actually breed disease.

In the future, or as long as education shall be general, truth alone will control the earnest, scientific inquirer, and only definite, consistent, and demonstrable results will receive general acquiescence. Science deals with realities, and must act upon what it knows and can prove, and is unlike faith, which is based upon what is desired or believed. Should science ever become dogmatic, its errors will be on the side of actual knowledge. To the possible influence for good, which lies within the legitimate domain of a voluntary association of this kind, composed of competent, earnest laborers for the prevention of disease and the preservation of the public health, we can assign no limit.

Sanitary observances of some sort, though often crude and meagre, are a kind of instinct. To elevate this perception in man to the position of an actual science, is the duty of an advancing civilization. Hygienic regulations are older than the Christian Era, and were made a part of the religious dispensation promulgated by the inspired law-giver of Israel. It is, therefore, a neglected, rather than a new, or an unknown science. Hygienic blessings are not the property of any people or age, of one clime or nation; they belong to mankind of both high and low condition — the rich and the poor, the intelligent and the ignorant — at all seasons and in all places,

wherever man travels by land or by water, whether he tarries in tents, palaces, crowded cities, or in the open country. To make the knowledge of sanitary science possessed by the educated, serviceable for the protection of the people, requires great discretion, perseverance, and fortitude on the part of those charged with the duty. While there remains with the many a rooted ignorance, and a sensitive antagonism to reform, we believe that, except in extreme cases, more rapid progress can be made by developing, educating, and leading public sentiment, than by attempting too soon to enforce compliance with sanitary laws. The growing necessities for increased hygienic precautions, created by an advancing civilization, are fortunately being understood and provided for at every point, as rapidly as could reasonably be expected. The accumulated knowledge of the science is developing resources for the enforcement of its dictates, and the highest skill of the architect, the chemist, the engineer, and the physician is employed in its service. The scientist and the expert are now called on for their opinion by courts of justice, and their judgments relied upon by capitalists and merchants. But perhaps in no department of civil polity has there been greater progress made than in the development of a sentiment that encourages the organization, in nearly all American cities, of efficient boards of health, and the practical application of sanitary agencies in the prevention of disease. Great, however, as has been the improvement in this direction, there still remains much to be done, both to educate the public mind to a full appreciation of the importance of hygienic observance, and to bring into practice the needed reforms. The value of sanitary knowledge has frequently been put fairly upon trial, and the application of scientific measures confidently resorted to for the protection of the public health. In great emergencies, health officers have staked their reputation on the pledge to arrest the spread or mitigate the severity of infectious diseases, by ventilation, by the removal of filth, by the separation of the sick from the healthy, and by the free use of disinfectants, vaccination, and other rational agencies. Such tests have often been forced upon the medical profession, and that too in communities determined not otherwise to be convinced, either of the necessity or efficiency of sanitary measures, but always with good results, which, if not acknowledged by the masses, were felt and appreciated by the more intelligent citizens. We must study the antecedent habits and conditions of the sick, the surroundings of disease, and the salubrity of localities. The discovery and recognition of evils must precede their removal. The repeated demonstration of the invariable relation of cause and effect will finally convince the most obdurate. It is in the neglected localities, and among the poorer classes of society that sanitary regulations and appliances have won their greatest triumphs. We hope yet to see hygienic principles become a part of primary education, and we trust that active co-workers will arise in every community and assist in a reform, from which the poor must reap the greatest benefits. As evidencing the progress that preventive medicine is making in Europe, I may mention the fact that the Queen of Great Britain, in her speech, August 13, 1875, on the occasion of the prorogation of Parliament, paid a deserved and handsome

compliment to the influence that sanitary regulations have exerted in securing better dwellings for the poor, and the better protection of the public health. This recognition, by the head of the most enlightened court in Europe, is encouraging to the cause, when we consider that the first sanitary survey of the large cities of Great Britain was made in 1843, and the first general Public Health Act was only passed August 31, 1848. France, as early as 1802, established a Council of Health for Paris, and in 1851 extended it to the whole country.[1]

The progress of public sentiment concerning State Medicine in the United States is illustrated by the fact that nine States have now organized State Boards of Health ;[2] some of them publish annually reports of great practical value. Many special inquiries, instituted under the supervision of these Boards, are thorough scientific examinations of the sanitary conditions affecting the health of large communities.

The plan adopted by some of the State Boards, and indeed by some City Boards, of intrusting the investigation of the causes producing particular diseases to gentlemen of scientific attainments and practical ability, though not officially connected with the respective organizations, has led to the preparation of very able papers.[3]

[1] The Queen, in her speech, on the occasion of the prorogation of Parliament, says : "I have with pleasure given my assent to an Act for facilitating the improvement of the dwellings of the working classes in large towns, which will, I trust, lead to the decrease of many of the principal causes of disease, misery, and crime. I feel sure that this legislation, together with that relating to the consolidation and amendment of the sanitary laws relating to friendly societies, will greatly promote the moral and physical welfare of the people." — *London Times, August* 13, 1875.

[2] The following are the States that have State Boards of Health, with the year when established. Those marked with a star (*) publish reports annually.

Alabama	1875.	Massachusetts *	1869.
California *	1870.	Michigan *	1873.
Georgia	1874.	Minnesota *	1872.
Louisiana *	1870.	Virginia	1872.
Maryland	1874.		

[3] The following are the titles of some of the leading papers in the Massachusetts State Board of Health, — reports written chiefly by gentlemen not connected officially with the Health Department : "Ventilation of School-houses," by A. C. Martin, Architect, 1871 ; "Arsenic in certain Green Colors," by Frank W. Draper, M. D., 1872 ; "The Effect of Sewing Machines on Health," by A. H. Nichols, M. D., 1872 ; "Vegetable Parasites, and the Diseases caused by their Growth," by J. C. White, M. D., 1872 ; "Drainage for Health," by H. F. French, 1873 ; "Infant Mortality," by Edward Jarvis, M. D., 1873 ; "The Food of the People of Massachusetts," by George Darby, M. D., 1873 ; "Causes Antecedent to Consumption," by H. I. Bowditch, M. D., 1873 ; "Adulteration, and Impurities of Food," by H. B. Hill, 1873 ; "Cerebro-Spinal Meningitis in Massachusetts," by J. B. Upham, M. D., 1874 ; "Political Economy of Health," by Edward Jarvis, M. D., 1874 ; "School Hygiene," by F. Winslow, M. D., 1874 ; J. F. A. Adams, M. D., on the "Health of Farmers of Massachusetts," 1874. Additional papers might be named both in the Massachusetts reports and in those of California, Michigan, and Louisiana, and others of much practical value. Alabama should perhaps be mentioned ; her contributions are to be found in the transactions of the Alabama State Medical Association.

The special study by Dr. Baker, of the Michigan State Board of Health, on the causes of Spinal Meningitis, was admirable and thorough. It is probable that it has not settled any point in dispute ; nevertheless, the inquiry was original and specific, as to certain sup-

No doubt all have observed with satisfaction, that more contributions to the literature of State Medicine have been made since our last meeting by American sanitarians, than have been published in any preceding year.[1]

From a correspondence with influential physicians who keep abreast of the most advanced medical views and discoveries, and who are familiar with the sentiments and wants of the people in States that have not yet organized State Boards of Health,[2] I am justified in saying that in nearly every State

posed factors, the only plan that ever leads to any real advancement or increase of knowledge.

[1] Among the publications of value may be named, *The Sanitarian*, an ably conducted and permanently established journal devoted to the interests of State Medicine.

The volume of Vital Statistics accompanying the last United States Census has had so limited a circulation, that the number of valuable facts it contains have scarcely yet come to be appreciated. It richly deserves to be studied.

Notably as a work of great merit is the publication by the Surgeon-general, entitled, *Hygiene of the United States Army*. This work has done for all the posts of the army what I hope to see accomplished for every part of our country. In it all factors of climate, location, and the like have been duly considered in their effect upon health. Following the publication named and from the same department is an admirable and exhaustive report on a plan for transporting sick and wounded soldiers by railroad in time of war, by Dr. G. A. Otis, Surgeon United States Army. The very excellent report on the Cholera of 1873, by Dr. Ely McClellan, has already been referred to in another part of this paper, as have other valuable articles on sanitary subjects in the different State Boards of Health. The reports of the Board of Health of the City of New York are most important contributions to our knowledge of sanitary laws and the efficiency of the art in protecting public health. Philadelphia and other cities have also published reports of their sanitary condition and the operations of their health departments during the year, all of which show great advancement in the hygiene regulations of our large cities.

The report on the small-pox epidemic at Mobile in 1874–75, by Jerome Cochran, M. D., is a contribution of much interest to the practical sanitarian.

There also have been many special studies of much interest, notably Dr. Minor's "Scarlatina Statistics of the United States." Admirable articles relating to Preventive Medicine have appeared in the *Popular Science Monthly*, and in other publications, which evince the interest the public takes in these subjects.

[2] The following are the States whose legislatures have not yet authorized the organization of State Boards of Health and the registration of vital statistics. But two States — Massachusetts and Rhode Island — have methods of registration that give satisfactory results. States where the question of organizing such boards has been before the legislature, and is likely to come before the next assembly, are marked with a star (*). States marked with a dagger, (†) have or have had in the past some system of registration of vital statistics of births, marriages, and deaths.

Arkansas.*	New Hampshire.* †
Connecticut.*	New Jersey.*
Delaware.	New York.*
Florida.*	North Carolina.
Illinois.	Ohio.*
Indiana.*	Oregon.*
Iowa.	Pennsylvania.* †
Kansas.	Rhode Island.†
Kentucky.* †	South Carolina.
Maine.*	Tennessee.*
Mississippi.	Texas.*
Missouri.*	Vermont.*
Nebraska.*	West Virginia.* †
Nevada.	Wisconsin.*

the medical profession, and the leading citizens of all classes, are convinced of the utility of such boards, and also of the propriety of the adoption of a proper system of registration of vital statistics; and they are making such representations to the several legislatures as will secure their establishment in all the States within a few years. The friends of State Medicine everywhere recognize the valuable aid that has been given to the cause by the labors of this Association in popularizing its purposes, and in making evident its economic and sanitary advantages. It is earnestly hoped that the predictions of the friends of hygiene may be speedily realized, and that every State may have its Board of Health and registration of vital statistics; and that every city and county within the several States may also have their health organization all working harmoniously together.

The Legislature of Massachusetts, in 1849, passed a law for the appointment of three commissioners to make a "Sanitary Survey of the State." This commission consisted of three physicians, who made patient and thorough inquiry into the causes affecting the health of the cities and other localities, including the various manufacturing establishments throughout the Commonwealth.[1]

It is to be regretted that all the States do not, from time to time, order medical surveys, comprehensive enough to embrace all the important factors that affect the health of their citizens.

It is scarcely necessary to repeat what has been so often suggested, that Boards of Health — State and municipal — ought to have at least one member who is a competent civil engineer.

The duties of sanitary inspector are second to those of no official connected with the preservation of the health of a city. His examination, if timely and thoroughly performed, and his sanitary injunctions enforced, will often prevent the necessity for calling in the clinical physician, and certainly "prevention is better than cure." To the unceasing efforts of the guardians of health is due the fair degree of salubrity enjoyed by cities. It seems that great aggregations of human beings in central marts are a necessity to our form of civilization. It is our aim to keep the city as salubrious as the country. Sanitary science and its appliances must meet these requirements, and preserve both to the palace and the tenement-house as favorable hygienic conditions as are enjoyed by the farm-house and rural cottage. This can never be done except by daily sanitary inspection, and a rigid enforcement of the requisite hygienic regulations. This work of the health inspector, like that of the housewife, is *never done*.

Pure water for potable use is essential to the health of a people. As water is sometimes rendered unfit for domestic use by the soil and rock strata through which it percolates, so, too, may it be rendered dangerous to

[1] This commission made a very comprehensive report, which was printed in 1850. It is a great storehouse of valuable information concerning the actual condition of the public health of Massachusetts at that time, and embraces all that could be collected to elucidate the application of sanitary science to the protection of health. Although it is more than a quarter of a century since Massachusetts made this report on her sanitary condition, not one State has imitated her example.

health by becoming the vehicle of the germs of disease negligently strewn or exposed in the vicinity of springs and wells. Streams of pure water may also be contaminated by sewerage and offal from establishments and factories emptying into them along their course. By the laws of the several States, and of the General Government, streams should everywhere be protected from contamination. No defilement ought to be permitted that will injure the fish in them, or render the water unfit for domestic use.

The principle must be recognized by persons living along water-courses, that while they have a right to use the water, they must do so in a manner not to destroy the right of their neighbors. Precautions of this order are particularly called for along streams that furnish water for domestic use.

Some of the oldest and best preserved architectural monuments of the human race are those connected with the furnishing water to cities, and with establishments intended for the promotion of the public health.[1]

The water supply of a city is of the highest importance, and its free use, though not its waste, ought to be encouraged. We frequently see in water registers' reports the complaint that too much water is used or wasted, and the admonition to the community of the threatened scarcity in consequence. Inspectors ought to be charged with detecting unreasonable waste. But fresh water ought to be as free as air, and provided in great abundance. No city ought to consider its water supply satisfactory, that cannot afford to have fifty times as much water wasted as is required for strict domestic use. Closets left part of the time without water, or with but insufficient flow to flush them, must of necessity become foul, and defeat the best sanitary arrangements. The more water that can be allowed to pass through closets, and other house connections to the sewers, the better it will clear both the pipes and the sewers, and thereby prevent the formation of dangerous gases. The various factories and arts conducted in cities, requiring water, ought to supply themselves by boring artesian wells. Every housekeeper within a city corporation is entitled to an adequate amount of pure potable water. *A manufacturing establishment, however, has no such claim.*

Among the many suggestions which may be made in furtherance of the collection of facts that are of interest to the medical profession, I venture to mention that in regard to the manner of taking meteorological observa-

[1] Some of the finest and most ancient engineering monuments of the human race, are those that were connected with sewerage, drainage, irrigation, and water supplies to cities, and with establishments intended for the promotion of the public health. The Aqueduct known as the "Pont du Gard," near Nismes in France, and the ruins of the superb Nymphæum or baths are among the most imposing remains of ancient architecture. They are of Roman construction, but of what date is unknown. An aqueduct built by Quintus Sertorius seventy-five years B. C., at Evora or Ebora, Portugal, is, or was in good condition but a few years since.[1] It is probable that it has been permitted to get out of repair, as the beautiful circular castellum or tower which terminated the aqueduct has, according to the accounts of recent travellers, been demolished, that a public market might occupy the site. Thus has been destroyed within our own time one of the most beautiful relics of Roman architecture that remained in the world. But what of sentiment could be expected of a people who, in the same city, permitted the beautiful Temple of Diana to be used as a slaughter-house.

[1] James Murphy, *Travels in Portugal.*

tions. Men live and carry on all their various avocations in an atmosphere only a few feet above the earth. A more important and comprehensive record of the actual meteorological phenomena occurring in the limited belt or sphere of man's activities, might be obtained, if all observations of temperature, moisture, rainfall, electricity, etc., were taken close to the earth. I allude to the subject with a view to encourage an exact uniformity of elevation and exposure of instruments in making observations. We are particularly interested in the conditions of the atmosphere we breathe, and should desire to know its exact conditions and extremes of variations. It is a well-ascertained fact, that the rain-gauge registers in the same locality more at the earth's surface than when placed at a considerable height. Changes of temperature, too, are effected by elevation, by radiation from the earth according to the seasons, and during the different hours of day and night. The thermometer ought, in my opinion, to be placed close to the earth, and never more than five feet above it, and be remote from buildings shaded from the direct rays of the sun; but exposed to the free currents of air, though cut off from the radiated heat from the ground.

We are gratified to observe that the importance of hygiene and sanitary inquiries engaged the attention of the last Congress of the United States, which passed an act authorizing the Surgeon-general of the Army, and the chief of the Marine Hospital Service, to investigate the history and cause of the cholera epidemic of 1873, and of the yellow fever epidemic during the same year — the first named to report on cholera, and the latter on yellow fever.[1] The researches of these departments have resulted in the publication of valuable reports, which have added much to our knowledge of the history and characteristics of these diseases. Congress, too, with an awakening sense of its duties and responsibilities, is beginning to consider the subject of the food supply of the people. This indeed is a most important question to every government. An Act of Congress of 1873, authorized the organization of a "United States Commission of Fish and Fisheries;" the labors of this commission are chiefly directed to an investigation of the food fishes of the American coast and rivers.[2]

[1] Dr. Ely McClellan, of the United States Army, was assigned to this duty by the Surgeon-general. His report has just been given to the public, and is, in my opinion, the most careful and exhaustive clinical history of an epidemic of cholera ever published. The bibliography of cholera, which accompanies the report, furnished by Dr. J. S. Billings, will prove of great value to all students and writers upon this disease.

Dr. Frank W. Reily, of the Marine Hospital Service, has made a comprehensive report on the yellow fever of 1873, which has been published by the Marine Hospital Department.

[2] Professor Spencer F. Baird was appointed Commissioner, and has made a most valuable report on the "Condition of the Sea Fisheries of the South Coast of New England." This report touches upon almost every question relating to the food fishes of America, and shows their economic value to the nation and their importance to the people. Our government is from time to time founding new departments in the interest of its citizens. Thus, the Interior Department was established by law, March 3, 1849. The Secretary of the Interior has a seat in the Cabinet and is the head of all the home departments, such as the Land, the Pension, and Patent offices. The Agricultural Department was made independent May 15, 1862. The Bureau of Education was created by law, March 2, 1867, and similar institutions followed in regular sequence. It is believed by many that a Bureau of Vital Statistics ought now to be established.

This action of the government suggests an extension of the principle to other matters intimately connected with the obligation to consider all the conditions that relate to feeding, clothing, housing, and the general well-being of the people.

The meteorological observations being collected so systematically, and from all parts of our country, by the United States Signal Office, present a vast field for the study of the influence of climate, storms, and the like, upon health. The facts collected by this department are yearly coming to be more sought after by the physician. There is no occupation or mode of life that does not deserve to be investigated as to its influence upon health. Man's surroundings, his domicile, his clothing, his food, his habits, in childhood, in mature years, and in old age, all should be observed, with a view to discover the conditions which develop the highest vigor of body and mind, and secure the greatest longevity. We assume that life is a blessing. To preserve it is a duty, if not a virtue. No circumstance is, therefore, trivial, that can unfavorably affect health or shorten our existence. Man's social instinct and moral nature in a measure make him "his brother's keeper." It is surely, therefore, a natural, if not a Christian duty, resting upon all persons possessing the knowledge, — to point out the physical evils which flow from bad habits, and from the neglect of hygiene.

The statement is often made, and is generally believed, that residents of rural districts enjoy a higher average degree of health, physical strength, and a greater longevity than those who live in cities. If this opinion be correct, what are the conditions that secure such results? I am inclined to think that regular habits, as well as fresh food and pure air, have much to do in the attainment of this higher degree of vitality which common belief assigns to a rural life. A philosopher says: "Habits make the man." One of the most notable differences in the habits of the two is in the hours chosen for retiring. Country people undoubtedly sleep more, and have fewer disturbances during the night than the residents of cities. Can it be that peaceful lives, with abundance of sleep, are the chief factors in securing vigor, good health, and longevity? It seems probable that such is the case. Examples in confirmation of this view, will, I believe, occur to every one. The want of sufficient sleep at the proper time is, in my opinion, a fruitful cause of disordered functions and impaired health.

It is not likely that any suggestions of mine will lead to reform in this particular, but it is not, therefore, the less a duty to point out what contributes to vicious habits, and indicate the causes that are probably involved in the deterioration of the vital forces.

As conducing to an amendment in this regard, I would suggest that in cities all licensed restaurants and bars should be required by law to close at ten o'clock, and that theatres, and other places of amusement, commence at seven o'clock, so as to close at ten, or eleven at the latest. If it were possible to add one hour each night to the sleep of the residents of cities, I feel persuaded it would do much to elevate morals and preserve health.

A great American statesman is reported to have said that large cities are the plague spots of nations. Whether this be true or not in a political sense,

there are many who believe that cities are in danger of becoming amenable to the charge in a sanitary point of view. The overcrowding that always takes place is to be deplored, and deserves the attention of statesmen and legislators. Large aggregations of people are constantly in a condition to be surprised by some contagious disease. Is it not reasonable that health organizations should in some way favor cheap transportation from cities into the country, so as to relieve the crowding of tenement houses.[1] A measure of this kind, with a homestead exemption law, which would secure a cheap home even thirty miles from the city, with a lot for a garden to the head of a family, might do something to encourage a considerable number to live in the country, who now crowd into all sorts of abodes in large cities.

A homestead exemption law would probably give great encouragement to the poor of economic disposition, and who would take advantage of it for the sake of a home where they might hope to raise their children to adult life, to do which is next to impossible in crowded cities. A law of this nature, or any other measure that would multiply small homes, and encourage rural life and garden culture, ought to be welcomed, since it is a recognized principle in political economy that the greater the number of small land-owners, the greater the strength and stability of a nation.

Among the multitude of questions that press for consideration, there is one upon which I wish to say a word, as I understand it to be a usage, in some localities, and which I am sure all will agree in condemning as heartless and inhuman, namely, the practice of not removing a drowned person from the water immediately on discovery. Man's better instincts revolt at so barbarous a custom. I am informed that the opinion prevails, that individuals render themselves liable to prosecution if they meddle with a drowned body, even to attempt resuscitation, until the coroner arrives and assumes control. Such delay and inference as to any law upon the subject ought not to be sanctioned by our silence, as it is contrary both to the dictates of humanity and public policy. In cases of recent drowning, not a moment should be lost in removing the body from the water. It is well known that many lives have been saved even in cases of apparently complete drowning, by prompt, intelligent, and persistent efforts at resuscitation. When a body that has not been longer than thirty or forty minutes under water can be recovered, attempts to effect a revival should be immediately commenced, by all such manipulations as will imitate natural breathing, whether in a boat or on shore, and they should be continued for more than half an hour. Any neglect of this duty ought to be esteemed highly reprehensible.[2]

[1] The running of trains at cheap rates of fare, morning and evening, was begun as an experiment in Boston in November, 1872. The trains run at hours to suit the laboring classes finding employment in the city, — the fare being but five cents each way, as far as Lynn, which is twelve miles. From the pages of the *Sanitarian* of July, 1875, I learn that the project is encouraging many to live in comfort in the country with their families, that hitherto had been crowded in a single room in a city. I trust that other large centres of population will imitate this example, and that, added to cheap fare may be some legislation that will secure a homestead, free from levy and execution, to heads of families.

[2] I have alluded to this matter, because several distressing cases of drowning have oc-

If the health and police regulations of cities having water fronts, do not contain laws in accordance with these principles, they must, I think, be considered defective, and should at once be amended. The sentiment, too, ought to be widely inculcated among all classes that it is man's imperative duty in every case of recent drowning to instantly remove the body from the water and to make every endeavor to induce resuscitation.

A Commission on Forestry for the United States was discussed at the last Congress, but failed to become a law, though the expediency of establishing some means to preserve the natural forests from wanton or negligent destruction, as well as the foundation of a systematic and comprehensive plan for planting trees, was fully brought before the public, in the discussion in the House of Representatives, and particularly in the report upon the subject made by the "Committee on the Public Lands,"[1] which recommended the enactment of a law for the appointment of a commission.

It is generally conceded that the rapid exhaustion of the great forests of our country has wrought important changes in our climate, disturbing the regular and equal distribution of rain.

Too much importance cannot be attached to the planting and preservation of trees, not only in the country but along all streets, and in every practicable locality in cities. Their vigorous growth along streets will shield from the glare of the sun, and if numerous, preserve by their refrigeration a slightly lower temperature in summer, and lessen the amount of dust on thoroughfares, and thus add to comfort and health during the heated term. The question of the importance of preserving timber for climatic, economic, and hygienic purposes will, it is understood, be presented to this Association by a gentleman who has given great attention to the subject.[2]

curred during the summer when all such effort seems to have been neglected. In the case of the drowning at the New Jersey Ferry wharf in the city of New York, August 16, 1875, of Robert C. Belville, Esq., of Trenton, N. J., the New York papers stated the body was secured "within twenty or twenty-five minutes after immersion." Instead of being taken out of the water, it was tied to the wharf, and remained in the water for several hours. Even when the friends of the unfortunate man had identified the body, it was not given up to them until the coroner could be found to give directions. The drowning of the Rev. Dr. Porteus of "All Soul's" Church, Brooklyn, who, while sailing, was capsized and drowned near shore, at Sea Cliff, L. I., is another case in point. According to the *New York Herald*, the senseless body of the Rev. Dr. Porteus was secured by parties in a yawl. Instead of lifting it into their boat, they towed it ashore, and even *then, the superstition* or *ignorance of the people prevented them from taking it out of the water*, and no efforts were made towards resuscitation! In this instance the body had been recovered within ten or fifteen minutes after the upsetting of the boat, and when it was still quite probable that life could have been saved. Another case is that of the death of W. C. Ralston of California. His body was recovered, and, I believe, taken out of the water within a very brief time after exhaustion or apparent death had taken place, but I have failed to learn that any efforts at resuscitation were made.

[1] Mr. Dunnell made a most comprehensive and valuable report (being No. 259, 1st Session 43d Congress), covering the whole question of the quantity of timber in the United States, the rapidity with which it is disappearing, its importance to the economic enterprises of the country, and, incidentally, the question of the influence of its disappearance on our climatology. The testimony of the pioneers of our western territory, as well as facts gathered from the history of other countries, goes to show that the rainfall in a region without timber is much less than after forests have been planted and cared for by man.

[2] Dr. Franklin B. Hough, of Lewis Co., N. Y.

Our country during the past year has been free from severe epidemics. Yellow fever appeared in some of our seaport cities. At Key West, and at Pensacola, Fla., where the government maintains both a military and a naval station, this disease appeared ; also at Milton, Fla., at West Pascagoula, Miss., and at Howell's Station, twenty-five miles above Pensacola ; and at Mobile, Ala., and at New Orleans, La. It was also taken to Brooklyn, N. Y., but by energetic measures of quarantine, and other hygienic and sanitary measures, the *scourge of the Gulf seaports* was suppressed wherever it appeared, not, however, until a number of deaths had occurred.[1]

The Marine Hospital Service, and the local government authorities in the South, have been working harmoniously and efficiently together during the past season under an old law of the United States, requiring the coöperation of the revenue and military forces with the State health or quarantine officers for the protection of the public health.

Among the preventable diseases, diphtheria has been fatal to a degree that attracts special attention in the mortuary reports [2] of the cities of New York, Brooklyn, Jersey City, Philadelphia, St. Louis, and Boston. Small-pox, too, has persisted in claiming an excessive percentage of deaths in the cities of New York, Brooklyn, St. Louis, Cincinnati, and other places.

Next to sewerage and drainage in its importance to health, we may place the lighting and ventilation of dwellings. Few others than physicians and health inspectors, who are called upon to attend the poor of large cities, crowded into tenement-houses, cellars, and garrets, can realize to what extent the breath, perspiration, and other excretions from the human body, detained in clothing or apartments, poison the atmosphere in which these people live. Often people of this class are so crowded together, that they are slowly but surely becoming their own executioners, and with poisons excreted from their own bodies. It is not generally realized that the excreta from the lungs and skin are greater in weight, for the twenty-four hours, than those from the kidneys and bowels.[3]

This, I apprehend, is contrary to the popular belief, yet it is nevertheless

[1] Dr. J. A. Bradford, of Pascagoula, Miss., died August 12, 1875. Surgeon G. M. Steinberg, of the U. S. A., was attacked, but recovered. The whole number of attacks amounted to about three hundred.

[2] See monthly synopsis of monthly mortality in our large cities, in the *Sanitarian*.

[3] *The Lungs.* — From an examination of the results of eighteen experiments of the quantity by weight of matter thrown off by the lungs in twenty-four hours, I find the average to be 787.178+ grammes, equivalent to 25.31+ ounces.

The Skin. — The average weight of matter excreted by the skin in twenty-four hours, as given by twenty experiments, is 1,074.811+ grammes, equivalent to 34.56+ ounces.

The Kidneys. — The average weight of matter excreted by the kidneys in twenty-four hours, in twenty-five experiments, is 1,298.76+ grammes, equivalent to 45.89+ ounces — fluid.

The Alimentary Canal. — The average weight of matter excreted by the bowels in twenty-four hours, as given by fifteen experiments, is 151.48+ grammes, equivalent to 4.87+ ounces.

The average amount of food taken in twenty-four hours, as given by twelve experiments, is 2,590.758+ grammes, equivalent to 80.30+ ounces. The experiments are too few to establish a law. The whole weight is less than the average amount excreted.

The total average weight of the excreta from the human body in twenty-four hours, as ascertained from fifty-five experiments, is 3,312.229 grammes, equal to 106.502+ ounces.

true. The excretions first named, too, are very minutely divided, and therefore become at once disseminated through the air of confined rooms, — and the poor of whom I speak, in cities have no other, — which is again taken into the lungs with every breath, and thus slowly but surely infuses a debilitating, or may be a deadly poison into the system.

Every apartment, when occupied by a number of persons for ten or a dozen hours, requires its vacation for rest and recovery from the exhaustion of its pure air. All sleeping as well as working rooms ought to have their period of regular daily free ventilation, so as to fully drive out all deteriorated or foul air.

To make more apparent the necessity for free airing of clothing, and ventilation of all rooms occupied by man, I have compiled a table of the amount in weight of the excreta from the human body in twenty-four hours, as ascertained by fifty-five experimenters. The lungs and skin throw off an average of 1.881+ grammes, and the kidneys and bowels average 1.449+ grammes. The Table is presented on pages 16–21.

A knowledge of these facts may assist the mind to comprehend the sources of danger, and the necessity for free and complete ventilation of apartments where men dwell or labor. Rooms that have much old furniture, clothing, or bedding require not only free air, but sunshine, and soap and water to cleanse them and dispel the odors acquired from filthy bodies and untidy habits in confined apartments. Indeed, there are in the quarters of the poor, often bed-clothing, garments, and furniture that are actually dangerous to health, and that ought to be declared a nuisance because of the foul odors that emanate from them.

But as ventilation will be discussed at this meeting by several able sanitarians, I feel justified in passing the subject with these few remarks.

Drainage must always be one of the most important of sanitary measures. The best means to effect the sewerage of cities is the great problem in sanitary science, and has engaged the attention of the most eminent engineers in Europe and America. Much progress has undoubtedly been made in both sewerage and drainage, but the question of the character, location, and construction of works of this kind which in the past so largely engaged the attention of the sanitary physician, is with propriety and advantage now mainly remanded to the practical engineer.

But as the sewerage of cities is among the questions which will probably be presented by others, and will, I have no doubt, be treated much more ably than I could hope to do, I shall confine my remarks to the general question of the drainage of rural districts, and the reclaiming of the marsh and swamp lands of our country. The extent of this class of lands is much greater than is generally supposed, and their unfavorable influence on health as well as their tendency to check the advance of population and limit the amount of productive soil, more positive. The possibility of increasing the areas of cultivable lands, and cheapening the value of fertile soil for small homesteads, adding thereby to the abundance, and lessening the cost of table supplies, deserves attention. There must exist a relation between tidy homes, industrious habits, and the cheapness and abundance of food con-

sumed by a people, and their moral and physical condition. Neither insufficient nor inferior food, nor filthy habitations, will develop physical vigor, good morals, noble instincts, or inspire to brave deeds. Much of the land in question, and capable of reclamation, lies along the shores of the Atlantic. Although geologists say the eastern coast of the continent is subsiding at a rate of perhaps one foot in a hundred years, yet the encroachment of the sea upon the land has in historical times not been appreciable to the ordinary observer. But even if this action be going on, the invasion of the land by water will not be sufficient to disturb coast improvements for thousands of years to come.

The shore of the Atlantic coast along the northeastern States is formed by the native and undisturbed rock. But southward from the harbor of Boston much of the shore is lined with alluvial deposits varying from 100 to 900 feet in depth. Here the shore lines are subject to change from abrasion by the waves and by the formation or disappearance of sand reefs.

Long Branch, and the New Jersey coast in the vicinity has suffered from this circumstance a loss of two hundred feet in breadth of its shore land in the course of forty years. Sand reefs are constantly forming and changing in certain localities, and generally in parallel lines with the shore. Cobb's Island, off the southern coast of Virginia, is enlarging some twenty feet a year. These formations are also growing and enlarging on the North Carolina coast and other localities. In some places the reefs are gradually elevated above tide by deposits of drift washed in from the sea, and by material brought down from more elevated lands in the vicinity. Sand dunes are formed in favorable localities by the winds on the Atlantic coast, from New England as far south as Florida and Texas. They are also found at San Francisco and other places on the Pacific. The remarkable projections into the sea of Cape Cod and Cape Hatteras on the Atlantic coast are alluvial or drift, probably the result of glacial action on the high mountains in the vicinity.[1]

The soil of Florida, resting chiefly upon coral reefs, has gained much from the erosion of the lofty mountains in Northern Georgia.

Many of the lagoons and swamps enclosed between these accretions and the main land are for a time partially land-locked bodies of brackish water. They gradually become shallow, and form reedy swamps, which in such condition are usually unhealthy; but when they are filled up or drained, they become arable and salubrious.

Hon. George P. Marsh, in a note to his work, "The Earth as Modified by Man" (p. 533), states that the Val de Chiana in Tuscany was once a large marsh, which remained for many years so unhealthy that the swallows did not visit it. These marshes have, however, by draining been largely reclaimed to agriculture and salubrity.

Through the kindness of P. C. Patterson, Superintendent of the United States Coast Survey, I am enabled to present the following estimated *areas of overflowed lands in the several States along the Atlantic and Gulf coasts.*

These statements are to be considered as approximate, because surveys

[1] The White Mountains of N. H., and the Bald Mountain of N. C.

Tables of the Weights of the Excretions from the Human Body giving the original weight,

Experimenter.	Lungs.		Skin.		Kidneys.	
	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.
Abernathy, John. Todd's Cyclop., vol. iv., pt. ii., p. 842.	....	....	2½ lbs	933.0	....	....
Allen & Pepys. Müller's Phys., vol. i., p. 325.	18,612 gr.	1,206.38	....	....	....	....
Andral & Gavarret. Longet, Traite de Phys., vol. i., p. 532.	....	984	....	....	....	....
Becquerel. Lehman's Phys. Chem., vol. ii., p. 157.	....	....	....	....	....	1,267.3 1,371.7
Becquerel & Rodier. Traite de Chim. Path., p. 273.	....	....	....	....	....	1,337.489 1.227.779
Blumenbach. Phys., p. 113	....	....	2 lbs.	746.4	....	....
Carpenter, Wm. B. Phys., p. 578	16 to 20 oz. H_2O.	497.6+ to 622.0+	....	....	....	....
Cruikshank. Todd's Cyclop. ,vol. iv., pt. ii., p. 842.	....	....	7 lb. 6 oz.	2,799.0	....	....
Dalton. Valentin's Phys., vol. i., p. 725...	....	....	....	....	....	1,446.0 1,535.0 1,448.0
Dalton, J. C. Jr. Phys., p. 370	1.630 lbs. CO_2. 1.115 lbs. H_2O.	608.99+ CO_2. 418.14+ H_2O.	1.930 lbs.	720.27+	2,157 lbs.	804.99+
Davy. Müller's Phys., vol. i., p. 325.......	17,811 gr.	1,153.44	....	....	....	....
Dodart. Todd's Cyclop., vol. iv., pt. ii., p. 842.	....	....	40 oz. 3 dr. 26 gr. 26 oz. 46 gr.	1,257.34 811.58	....	....
Draper, John C. Draper's Anat. Phys. and Hyg., p. 113.	....	464	....	664	....	1,106
Dumas. Marshall's Outlines of Phys., p. 827	9,800 gr.	635.28	....	....	....	....
Edwards, Milne H. Leçons sur la Phys., vol. ii., p. 504.	....	746.4	....	....	....	....
Grehant, Nestor. Robin's Jour. de l' Anat. et de la Phys., July, 1864, p. 523, *et seq.*	....	1,108.5	....	....	....	....
Hammond, Wm. A. Flint's Phys., vol. ii., p. 395.	....	....	....	....	....	....
Hammond, Wm. A. Am. Jour. Med. Sc., vol. lxii., 1856, p. 330.	....	....	....	....	36.55 oz.	1,136.785
Hammond, Wm. A. Am. Jour. Med. Sc., *loc. cit.*	....	....	....	....	43.56 oz.	1,354.716
Hammond, Wm. A. Am. Jour. Med. Sc., *loc. cit.*	....	....	....	....	32.14 oz.	999.554
Hammond, Wm. A. Am. Jour. Med. Sc., *loc. cit.*	....	....	....	....	31.18 oz.	969.698
Hammond, Wm. A. Am. Jour. Med. Sc.	....	....	....	....	34.78 oz.	1,081.967

in Twenty-four Hours, as determined by different Experimenters, and same reduced to grammes.[1]

Alimentary Canal.		Weight of Body.		Quantity of Food Taken.		
Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Remarks descriptive of the conditions under which the experiments were made, given as nearly as possible in the language of the Experimenter.
....	....	....	....	....	....	Experiment continued six hours on hand, which was assumed equal to 1-60th of whole body.
....	....	....	....	....	....	
....	....	....	....	....	....	Experiment on thirty-seven men and twenty-six women.
....	....	....	....	....	....	Mean of observations on four men.
....	....	....	....	....	....	Mean of observations on four women.
....	....	....	....	....	....	Experiment on a woman, the average being 1282.634 grammes in twenty-four hours.
....	....	....	....	....	....	Experiment on a man.
....	....	....	....	....	....	In a well-grown adult, the integument estimated at fifteen square feet.
....	....	....	....	....	....	
....	....	....	....	....	....	Experiment on hand, continued one hour.
....	149	....	....	....	2,714.0	Experiments in March.
....	30	....	....	....	2,877.0	Experiments in June.
....	191	....	....	....	2,924.0	Experiments in September.
.358 lb.	132.60+	140 lbs.	....	7.230 lbs.	2,698.25	The quantity of food taken was, oxygen, 1.470 lbs.; H_2O, 4.535 lbs.; albuminous matter, .305 lb., starch, .660 lb.; fats, .220 lb.; salt, .040 lb. A quantity of matter equal to the weight of the body passes through the system in twenty days.
....	....	....	....	....	....	
....	....	....	....	....	....	During summer months.
....	....	....	....	....	....	During winter months.
....	159	....	....	....	2,373	"In my experiments," Prof. D. says, "all sources of error have been carefully avoided. The body has always been in the normal condition, during the day employed in the usual avocations, at night at rest in bed.
....	....	....	....	....	....	For an adult man of medium size, not engaged in any special exercise or labor.
....	....	....	....	....	....	The quantity given by the experimenter is 31.1 grms. in one hour, and has been calculated for twenty-four hours.
....	....	....	....	....	....	The expired matter consisted of exhaled air, 551.5 grms., and watery vapor, 557 grms.
5.24 oz.	162.964+	....	....	....	....	
....	....	205 lbs.	....	71 oz.	2,208.1	The quantity of food taken, potatoes, 8 oz., bread, 12 oz.; beef, 16 oz.; butter, 1 oz.; salt, 2 drms.; water, 32 oz. Experiments upon himself for ten days; age, 27 years; average temperature, 84° Fahr.; sleep, 8 hours; study, 7 hours; recreation, 6 hours; eating, etc., 3 hours.
....	....	205 lbs.	....	71 oz.	2,208.1	The quantity of food same as above; hours of mental exercise doubled by taking three from sleep and four from recreation. Average temp., 82° Fahr. Continued ten days.
....	....	205 lbs.	....	71 oz.	2,208.1	The quantity of food as above; mental exercise as slight as possible; seven hours devoted to amusement, light reading, etc. Average temp., 77° Fahr.; continued ten days.
....	....	205 lbs.	....	71 oz.	2,208.1	Quality of food altered by substituting thirty-two oz. of strong black tea for water. The same conditions observed as in first experiment. Mean temp., 70° Fahr.; continued ten days.
....	....	205 lbs.	....	71 oz.	2,208.1	Quality of food altered by substituting thirty-two oz. of strong coffee for water. The same conditions observed as in first experiment. Mean temperature, 71° Fahr.; continued ten days.

[1] N. B. — All experiments have been by calculation brought to a standard of twenty-four hours, and where no specific weight has been mentioned the Troy pound has been assumed as a basis of calculation.

Tables of the Weights of the Excretions from the Human Body giving the original weight,

Experimenter.	Lungs.		Skin.		Kidneys.	
	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.
Hammond, Wm. A. Md. & Va. Med. Jour., vol. xv., p. 456	....	....	....	....	....	....
Hartman. Todd's Cyclop., vol. iv., pt. ii., p. 843.	....	....	45 to 65 oz.	1,399.5 to 1,430.6	....	....
Keil, James. Quincy Medicina Statica, p. 321.	....	....	30 oz.	933.0	2 lbs. 6 oz.	933.0
Keile. Valentin's Phys., vol. i., p. 725.	....	....	....	....	....	1,179
Krause & Valentin. Flint's Phys., vol. iii., p. 137.	....	....	30 oz.	933	....	....
Lecanu. Valentin's Phys., vol. i., p. 655 ..	....	....	....	....	....	1,268
Lecanu. Lehmann's Phys. Chem., vol. iii., p. 157.	....	....	....	....	....	522 to 2,271
Lehmann. Valentin's Phys., vol. i., p. 655.	....	....	....	....	....	1,057.8
Lavoisier & Seguin. Flint's Phys., vol. iii., p. 139.	....	....	30 oz.	933	....	....
Lavoisier & Seguin. Blumenbach's Phys., p. 114.	15 oz.	466.5	1 lb. 4 oz.	933	....	....
Lavoisier & Seguin. Müller's Phys., vol. i., p. 325.	....	....	8,534 grs.	553.07	....	....
Lining, Dr. John. Chalmer's Climate and Dis. of So. Carolina, vol. i., p. 223.	....	....	54.03 oz.	1,680.333	58.29 oz.	1,812.18+
Neubauer & Vogel. On the Urine, London, 1843, p. 355.	....	....	....	....	1,400 to 1,600 cc.	1,322.811 to 1,511.905
Parkes, Dr. Flint's Phys., vol. iii., p. 188..	....	....	....	....	52½ f. oz.	1,488.37+
Pettenkofer, Max, Dr. Robins's Jour. del' Anat. et del' Phys., vol. i., p. 429.	....	600 to 860 CO_2.	....	....	....	....
Regnault & Reisset. Flint's Phys., vol. i., pp. 430 to 451.	30.9 oz.	960.99	....	....	....	....
Robinson. Todd's Cyclop., vol. iv., pt. ii., p. 842.	....	....	27 to 30 oz.	839.7 to 933	....	....
Sanctorius of Venice. Quincy, John, M. D. Medicina Statica, Aphorisms of Sanctorius Translated, 1720, p. 48.	....	....	40 oz.	1,244.0	16 oz.	497.6
Sanctorius. Quincy Med. Stat., p. 47; Todd's Cyclop., vol. iv., pt. 2, p. 842 .	....	....	5 lbs.	1,866.0	69 oz.	2,145.9
Sanctorius. Quincy Med. Stat., p. 77......	....	....	3 lbs.	1,119.6	....	....
Sanctorius. Quincy Med. Stat., p. 45	½ lb.	186.6	....	....	....	....
Scharling. Valentin's Phys., vol. i., p. 604.	....	820.608	....	....	....	....
Seguin, in 1797. Longet Traite de Phys., vol. i., p. 532.	....	627.720 CO_2.	....	....	....	....

in Twenty-four Hours, as determined by different Experimenters, and same reduced to grammes. (*Continued.*)

Alimentary Canal.		Weight of Body.		Quantity of Food Taken.		
Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Remarks descriptive of the conditions under which the experiments were made, given as nearly as possible in the language of the Experimenter.
1,102.11 c. c.	....	165 lbs.	....	....	....	The food consisted of animal and vegetable substances; experiments on healthy males between twenty-three and twenty-five years.
....	....	....	....	....	....	
5 oz.	155.5	....	....	....	....	Experiments conducted in the same manner as those of Sanctorius, condition of health, living, and temperature being normal. The discrepancies between his and Sanctorius's observations, Dr. K. referred to the difference in the humidity of the atmosphere of Venice and that of Northampton, England.
....	149	....	....	....	2,252	Experiment upon a robust soldier aged 33 years.
....	....	....	....	....	....	
....	....	....	....	....	....	The quantity of urine varies from 743 to 2,271 grms. in twenty-four hours, the quantity given in the table being the mean.
....	....	....	....	....	....	Result of observations upon sixteen persons of various ages and sexes, a due quantity of mixed food having been taken by them.
....	....	....	....	....	....	Experiments upon himself, being under normal conditions, the quantity varying from 909 to 1,202.5 grms., while using a diet of one kind.
....	....	....	....	....	....	
....	....	....	....	....	....	Man put in a silk bag, varnished with gum elastic, and opening only for the mouth, so that by weighing previously and subsequently he had been able to ascertain what had been lost by vapor, and by subtracting this from the perspired contents of the bag, he estimates the amount passed off by the lungs.
....	....	....	....	....	....	
3.91 oz.	121.601	....	....	116.28 oz.	3,616.308	Excretions from lungs not estimated, but supposed to be included in perspiration. The experiment was conducted throughout the entire year, the quantity given in the table being the mean.
....	....	....	....	....	....	By well-nourished persons who drink freely. If we calculate the mean quantity of the urine by the weight of the body, we find that in an adult an average of one cc. per hour is passed for every two pounds (one kilogramme) of the weight of the body.
....	....	....	....	....	....	
....	....	....	....	....	....	With ordinary food. When undergoing alimentation with succulent food.
....	....	....	....	....	....	Carbon estimated from laboring classes, quantity less in non-laboring classes, organic matter, nitrogen, and ammonia not estimated.
....	....	....	....	....	....	During summer season.
....	....	....	....	....	....	During winter months.
4 oz.	124.4	....	....	....	....	This experiment was made in order to determine the amount lost by excretion in one night.
....	....	....	....	8 lbs.	2,985.6	Experiment was made in the warm humid air of Venice. The perspiration as understood by experimenter includes exhalations from the lungs and cutaneous surface. He used a balance of his own construction, weighing before and after meals and evacuations.
....	....	....	....	....	....	Perspiration during sleep.
....	....	....	....	....	....	Perspiration by the mouth in one day as determined by breathing upon a glass.
....	....	....	57.75 kil. =127.338 lbs.	....	....	Eight observations on a full-grown man, giving 34.192 grms. of CO_2 per hour.
....	....	....	....	....	....	The quantity as given by the experimenter is 26.155 grms. of CO_2 in one hour.

have not been finished in most of the States, and even when finished, they do not always extend to the head of the marsh region.

Maine contains 12 square miles.

New Hampshire contains 10 square miles.

Massachusetts contains 46 square miles.

Rhode Island contains 25 square miles.

New York contains 86 square miles. This is principally the marsh land along the southern coast of Long Island. Some fresh water swamp land in the interior of the States has been reclaimed by drainage.

New Jersey, 360 square miles, comprising the marshes of the Hackensack, the Delaware, and the sea-coast. Much land in this State has also been reclaimed.

Pennsylvania has eleven square miles, marshes, below Philadelphia.

Delaware has eighty-eight square miles. A good deal of land along the Delaware has been reclaimed by the construction of dykes.

The preceding figures give the present, and not the original extent of marsh land.

Maryland, 210 square miles.

Virginia, 500 square miles. This includes the Dismal Swamp region, covering about 190 square miles.

North Carolina, 3,540 square miles, of which about 3,000 is to be classed as swamp land.

Tables of the Weights of the Excretions from the Human Body giving the original weight,

Experimenters.	Lungs.		Skin.		Kidneys.	
	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.
Smith, Dr. Edward. Philos. Trans., 1857, p. 681.	26.193 oz. CO_2.	814.60+	....	....	....	....
Todd & Bowman. Todd & Bowman's Phys., p. 159.	....	....	....	....	....	....
Valentin. Valentin's Phys., vol. i.	....	....	....	....	....	1,125.621
Valentin, G. Valentin's Phys., p. 727, 1st day	....	....	....	....	....	1,041.8
2d day	....	....	....	....	....	1,387.8
3d day	....	....	....	....	....	1,913.5
Valentin, G. Valentin's Phys., p. 730	....	....	....	....	....	1,147.2
Valentin, G. Flint's Phys., vol. i., p. 430–451	30.9 oz.	960.99	....	....	....	....
Vierodt, Karl. Vierodt's Phys., p. 216	....	1,229.9	....	669.8	....	1,766.0
Way, Prof. Med. and Surg. Rep., vol. iv., p. 278.	....	....	2½ lbs.	933.0	3 lbs.	1,492.8
Wehrsarg. Flint's Phys., vol. ii., p. 395	....	....	....	....	....	....
Wundt, Wilhelm. Wundt's Phys., p. 373	....	....	....	500	....	....
Average	....	787.178+	....	1,074.811+	....	1,298.76+

South Carolina, 2,400 square miles. This includes 2,000 miles of swamp land, mostly under cultivation as rice land.

Georgia, 1,375 square miles, of which 425 miles consists of salt marsh.

Florida, 18,422 * square miles.[1]

Alabama, 750 * square miles.

Louisiana, 17,718 * square miles.

Mississippi, 4,798 * square miles.

Texas, 8,800 square miles, including about 400 miles of salt marsh. This last figure is but a rough estimate, because no surveys for about two thirds of the coast have been made. The total area embraced within this estimate, but which does not claim to be accurate, is 59,156 square miles, or 37,859,840 acres.

While the actual amount of swamp lands thus stated is great, it does not include immense bodies existing in the interior of our country, where the swamps do not communicate with the tide. I am informed by the honorable Commissioner of the United States Land Office, S. S. Burdette, Esq., that the whole amount of swamps and overflowed lands that have been certified to the several States, under acts of Congress since the passage of the law in 1850 to July 1, 1875, is 64,011,786 acres.[2]

[1] The star indicates that these estimates are from the Land Office.

[2] With a view to ascertain the quantity of swamp land that has been surveyed and certified by the United States, I addressed a note to the Hon. S. S. Burdette, Commissioner of the Land Office, requesting such information as he could furnish upon the subject. From

in Twenty-four Hours, as determined by different Experimenters, and same reduced to grammes. (Continued.)

Alimentary Canal.		Weight of Body.		Quantity of Food Taken.		
Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Weight as given by Experimenter.	Reduced to grammes for comparison.	Remarks descriptive of the conditions under which the experiments were made, given as nearly as possible in the language of the Experimenter.
....	....	....	....	....	....	Experiment conducted eighteen hours, the remaining six hours calculated for. Deductions made from eight sets of inquiries in four adult males in a state of rest.
5 to 6 oz.	155.5 to 186.6	....	....	Assum'g 35 oz.	1,088.5	Experiment upon a healthy man.
....	....	....	....	....	....	Experiment continued fourteen days, using a mixed diet.
....	214.5	....	....	....	3,199.9	Experiments upon himself, using Glardon's scale, weighing in a state of nudity fifteen times a day, taking into consideration that we lose one half gramme of perspiration per minute. The urine was measured by its volume and specific gravity.
....	153	....	....	....	2,778.7	
....	204.7	....	....	....	2,794.3	
....	189.6	....	....	....	2,923.20	Average quantity of food taken per hour being 121.80 grammes.
....	....	....	....	....	....	Organic matter, nitrogen, and ammonia not estimated.
....	172.0	....	....	....	....	This experiment was made upon a well-fed man.
4 oz.	124.4	....	....	....	....	
4.6 oz.	143.06	....	....	....	....	
....	....	....	....	....	....	The man was put in a vapor bath in a metallic vessel, and again a certain part of the body was placed in an air-tight bag, and the perspiration thus collected.
....	151.48+	....	....	....	2,590.758+	

Wet lands and saturated soils are not only unremunerative, but if the area is considerable, they prove a source of enervation and disease to the section in which they exist. Although individuals may neglect swamp lands, or find their reclamation and drainage too expensive, the State cannot afford to be indifferent to their continuance, because they check production, limit population, and reduce the standard of vigor and health. Their value, too, when reclaimed, in an economic view will be greatly enhanced.

It is well known to physicians, and it ought to be appreciated by statesmen, that conditions of insalubrity which enfeeble the vitality of a people are much more to be dreaded by a nation than even wars or great epidemics. A region or country noted for unhealthfulness, will increase neither in wealth nor in population. The elements which constitute the greatness of a nation are physical vigor, health, and enterprise in its population. To have these, the rulers must secure good sanitary conditions. While prosecuting inquiries as to the swamp lands of our country, and desiring to ascertain what efforts are being made for their reclamation by the several States, I have been permitted to examine a correspondence on the subject between the Hon. Fred. Watts, Commissioner of Agriculture, and the governors of the differ-

a lack of statistical data, the extent of actual swamps existing in the different States is not known, nor can it be learned what amount of such lands has been reclaimed. Yet as his communication furnishes the best information available I give it in full.

DEPARTMENT OF THE INTERIOR, GENERAL LAND OFFICE.

J. M. TONER, M. D.: —

Sir: In reply to that portion of your letter of the 18th instant requesting to be furnished with the amount of swamp lands in the different States, I have to inform you that the following statement will show the quantity of land selected as swamp and overflowed for the several states entitled thereto, from the date of the swamp grant, September 28, 1850, to July 1, 1875.

Ohio	54,438.14 acres.
Indiana	1,354,732.50 acres.
Illinois	3,267,470.65 acres.
Missouri	4,604,448.75 acres.
Alabama	479,514.44 acres.
Mississippi	3,070,645.29 acres.
Louisiana	11,339,546.83 acres.
Michigan	7,273,724.72 acres.
Arkansas	8,652,432.93 acres.
Florida	12,690,415.23 acres.
Wisconsin	4,200,669.58 acres.
Iowa	3,449,720.18 acres.
California	1,653,936.74 acres.
Minnesota	1,914,311.81 acres.
	64,006,007.79 acres.

In Oregon only a few tracts have been officially reported as swamp land, but from correspondence with the State authorities, I have no doubt that at least 500,000 acres, probably more, will be claimed in that State as swamp.

I would state that it is impossible for me to furnish you with the amount of swamp lands in those States in which the United States government had no control of the lands. This includes the original thirteen States, also Vermont, Maine, Kentucky, Tennessee, and Texas, and there are no records in this office in regard to the lands in those States. The grant has not been extended to Kansas, Nebraska, or Nevada, and does not extend to the Territories. — S. S. BURDETT.

ent States. This correspondence was commenced by the Commissioner at my request, and although some have not yet replied, excerpts of data, as far as received, will be found in a note.[1]

Two tunnels, one of them four miles long, the other somewhat shorter, cut through the solid limestone rocks, were made as early probably as the

[1] *Arizona Territory.* — No survey of the swamp and overflowed lands of this Territory has been made. The quantity of such lands is not known, but it is certain that there are no large swamps. The water-soaked lands are in the valleys along or adjacent to streams. A few such tracts have been reclaimed by ditching, and removing obstacles to the flow of water; and such lands prove very productive, "as they require but little or no irrigation." Swamp lands are considered very prejudicial to health, because they are believed to cause chills and fever in the fall. Draining and cultivation render these sections entirely salubrious. There has been no legislation on the subject of drainage. — A. K. SAFFORD, *Governor.*

Arkansas. — There has been no survey by the State of the swamp, overflowed or boggy lands; and the only means of approximating the quantity of swamp lands is to accept the survey of the General Land Office. It is estimated, however, that, originally, one third of the whole of the State was liable to overflow, and was actually water-soaked; but there is comparatively little that is deserving of the title of boggy. The system of reclaiming lands by levees and drainage was well under way, and much had been reclaimed to agriculture, when the war between the States began. Since then but little has been done, and many of the old levees and drains have been neglected. The conviction is general that drainage makes the region more salubrious, while it also enhances the value of the lands. All the reclaimed lands are very productive. Before the war, the State had adopted a method of encouraging the draining and reclaiming of wet lands by giving the title to the person who would actually drain and cultivate it. Perhaps one tenth of the wet and overflowed lands of the State of Arkansas has been reclaimed, and thus remains the most productive land to be found within her territory, and produces all the crops cultivated in the South. Even that portion which might be boggy is capable of being cultivated for rice. When this grain is cultivated in Arkansas, it proves to be of very fine quality, and is remunerative to the producer. The reclamation of the wet lands throughout the State, with the exception of the deeply overflowed section near the mouths of the White and Arkansas rivers is quite practicable, and will be of moderate cost. The reclamation of the latter localities will require stupendous levees; yet such can be built, and will completely effect their purpose. These lands would then sell at once for from twenty to fifty dollars per acre, which now are not only entirely valueless, but prevent occupation of the good lands in the vicinity. There is a growing desire to have the wet lands of the State reclaimed, but private enterprise is not equal to the task. In 1851, the State passed a law giving lands in payment to persons who would reclaim them. But at present the lands are not in demand on even these terms. — D. W. LEAR, *Department of State Land Office.*

California. — Although citizens of the State have in some respects taken the lead in systematic and extensive measures for the reclamation of her swamp land, yet she has made no comprehensive survey of the lands of this character. The whole extent of the swamp lands is estimated by the grants from the United States, and is given in another part of this paper. Some considerable areas of lands have been reclaimed. The soil here is so porous, and of such slight tenacity, that the banks of the streams do not stand currents or floods, and often give way. Says E. W. Maslin, Secretary to the Governor, these reclaimed lands are wonderfully rich and productive, — almost beyond belief. The population, except in a few localities, is not dense enough to suffer from these swamps, yet they no doubt lower the standard of health. The public press speaks encouragingly of the progress made in the reclamation of swamp and "Tide lands" in this State, but I have not the exact data from which to give results, but they exceed 2,000,000 acres.

Connecticut. — Bordering the small streams that enter the Sound are a few salt marshes of one or two miles in extent, and in almost all towns there are what are denominated "bog swamps," "alder swamp," "black-ash swamp," "tamarack swamp," or "peat beds." These occur wherever there is a depression in uplands from which there is no drainage, or

period of the Trojan war, to drain the lake Copais in Bœotia for economic and hygienic purposes. They existed and were repaired in the time of Al-

where a sluggish stream has been obstructed from any cause; but few of these are a mile in extent, and are included within adjoining farms. No survey of this class of lands has been made by the State, but it is estimated that one half of them have been wholly or in part reclaimed by drainage or by filling them up from the hills. Some of these recovered lands are very rich and productive where they are composed of earth, decayed vegetable matter, or the soil washed from the uplands. The swamps are so limited in extent as to but slightly affect health, although they are recognized as being prejudicial. Farmers on their own account are gradually recovering this class of lands for meadows, pasture, or tillage. A general law on the subject of reclaiming swamp lands in Connecticut gives a right to drain across adjoining property if necessary. — T. S GOLD, *for the Governor.*

Florida. — The quantity of swamp and boggy lands of this State can only be approximated, as no special survey has been made. The U. S. Land Office Surveys show about 4,000,000 acres. From a letter of M. A. Williams, an experienced surveyor in this State, to the Commissioner of Agriculture, I obtain the following facts: —

The swamp lands are distributed over almost all parts of the State. The largest body is the "Everglades," and the adjacent submerged savannas, containing possibly one half of the quantity estimated. The next largest areas are the prairies and swamp lands lying on either side of the Kissimmee River, and lands of like character lying at the head waters of the St. John's River. The San Pedro swamp, in Madison and Taylor counties, has about 35,000 acres. Swamps of smaller extent exist in almost every county of the State, aggregating a large amount. Almost all the rivers and water-courses are fringed with what are denominated "river swamp."

In addition to these are the salt marshes, an estimate of which has been given in the text. No effort has been made by the State to reclaim these swamp lands, but the Trustees of the Internal Improvement Fund have made some effort in this direction, but without any decided success. It will require good engineers, and a comprehensive system to be devised, to secure satisfactory results.

A few small tracts have been reclaimed by private enterprise, and the land found to be very productive. The sugar cane is found to be the most profitable crop for this kind of land. When such lands lie far enough south, they produce the banana, and other tropical fruits.

The "Everglades" cover a larger portion of the southern part of the peninsula, and embrace within their limits if they can be reclaimed, the richest land in the State. It may be proper to state that their reclamation is deemed possible, because they lie in a basin with a rocky rim, and are constantly above the sea level, as is proven by the rapid currents in the streams that flow from the whole area.

The popular belief in Florida is that the swamp, and boggy and water-soaked lands are prejudicial to health, but the salt marshes are not so included. I suspect that the latter should not be excluded The evidence is abundant that the salubrity of the whole State has greatly improved under the improved modes of cultivating the soil, the opening of drains, and the removing of obstructions to the water-courses and streams. Vast quantities of the lands are undoubtedly reclaimable, and it is thought would thereby greatly serve the interest of the public health, and thus deserve the attention and aid of the State. — A. M. WILLIAMS and DR. EGAN, *Commissioners of Lands.*

Dakota Territory. — There has been no complete survey of the lands of this territory, nor has there been any survey of the swamp lands. Some limited marsh basins exist in the unsettled parts of the territory, and along the Missouri River. It is claimed that miasmatic fevers do not exist here. Ditching, to protect the bottom lands along the Missouri, has been practiced to a limited extent by the owners residing there, and with good results. — A. W. BARBER, *for the Governor.*

Georgia. — It may be stated in a general way that there is a large extent of swamp, water-soaked, and overflowed lands in Georgia, equal in extent probably to the area of the kingdom of Holland. These lands lie chiefly along the course of the following rivers, to wit: the Ocmulgee, the Altamaha, the Savannah, Ogeechee, Oconee, and also along the

exander the Great, in the fourth century B. C. A tunnel of one mile in length, made through rock for the drainage of Lake Albano, fourteen miles

Flint. These lands have at present little, if any, market value; and yet, if they could be reclaimed, would be the most valuable in the State. The influence of the swamp lands upon the health of the adjacent districts is decidedly unfavorable. It is possible that in the future a system of levees may reclaim much of this rich and productive land to production and agriculture, influencing the salubrity, and increasing the wealth of the State. — P. W. ALEXANDER, *Secretary to Executive Department.*

Idaho Territory. — This territory has no swamp lands, except a few hundred acres around Bear Lake, in Bear Lake County. This region is all high table land, which requires irrigation to produce crops. — J. CURTIS, *Secretary of Territory.*

Indiana. — This State has made no special survey of the swamp, water-soaked, and boggy lands. The United States, under the Swamp Land Grant, gave Indiana 1,256,288 acres. These lands lie along the Kankakee, the Calumet, and the Wabash rivers; scattering tracts exist from west of the centre to the boundary of the State. It is estimated that a large part of the swamp lands have been either partially or completely reclaimed by straightening channels, confining streams, and drainage. The lands of the Calumet, a large amount of the northern part of the Kankakee, and most of the scattering tracts, have been drained, and are under successful cultivation. The soil is very productive, except in wet seasons when the drainage is insufficient; malarial fevers prevail in the region of these swamps, but decrease as they are drained and the lands cultivated. The lands themselves, as well as the surrounding tracts, are greatly enhanced in value, perhaps to the extent of one hundred per cent., or even more. Intelligent farmers, and many capitalists, are turning their attention to the reclamation of swamp lands, when they lie on public highways. Large owners of lands pay but little attention to drainage. But the subject is beginning to attract attention from an economic and sanitary point of view, and measures are from time to time introduced into the Legislature looking to a more complete and perfect drainage of the swamp and water-soaked lands of the State, to secure more profitable crops, and a higher standard of public health. — THOMAS A. HENDRICKS, *Governor.*

Iowa. — The extent of swamp, water-soaked, boggy, and overflowed land of this State is not accurately known. The amounts received by patents from the United States Land Office now aggregate perhaps 1,200,000 acres. There are but few specially swampy localities in the State, except those along the rivers. But so far, no surveys of this class of lands have been made. Much of the river swamp lands adjacent to cultivated soil, have been reclaimed by private enterprise. These reclaimed lands have been found among the most productive in the State, and agriculturalists expect similar results of lands yet to be reclaimed. When water-soaked and swampy lands, and sloughs, lie near cities and large towns, they are deemed prejudicial to health, although no complaints have yet come from the rural districts. Acts of the legislature invest the different counties with power to drain lands, at the request of proprietors of such lands, giving also the right to cross other lands to effect the purpose. Much land has been successfully reclaimed in Muscatine and Louisa counties, and there is no question among the farmers as to the practical success of systematic efforts at reclaiming nearly all the lands of the State to productive agriculture and that it will at the same time promote the public health. — W. H. HENNING, *Private Secretary to Governor.*

Kansas. — There are but few swamps in this State. There are, however, some lakes of from one to two hundred acres in extent, usually with well-defined bounds on one or two sides. The water is usually filled with fish. The shallow parts of these lakes are filled with vegetation: notable everywhere is the water-lily. A number of these lakes are found in the bottoms along the Missouri and Kansas Rivers. The overflows which were occasional in the early settlement of the State, have nearly ceased since the lands have been cultivated. The soil under tillage retains the moisture longer, and yields it more gradually, thus preventing overflows, and enlarged water-soaked areas. There has been no survey of this class of lands, though they are known to be of limited extent. Malarial diseases exist, but it is believed cultivation of the lands renders the attacks of such diseases less frequent and severe. When the wet or swampy lands have been drained and rendered arable, they have proven to be very productive. — ALFRED GRAY, *for the Governor.*

from Rome, was constructed in the year 397 before the Christian era, and is still in good condition. A remarkable work of this kind was partly com-

Kentucky. — The extent of swamp lands in this State is limited, the main body being in Hickman and Fulton counties, bordering on the Mississippi River in the southwest part of the State. This is the section known as the "Jackson purchase," and lies west of the Tennessee River and is the only portion of the State surveyed by the United States government. These lands are subject to overflow from the Mississippi River, and are comprised within a limited area. The State has not inaugurated any system of drainage or redemption of land from swamp. Many levees have been constructed by private enterprise, and some by joint-stock companies under State charters. The latter measure is of recent date, but promises good results, both in the land reclaimed and in its enhanced value. The other body of swamp land, embracing some 15,000 acres, is in Jefferson County, about ten miles south of Louisville. A joint-stock company is ditching and draining these lands, and already much has been reclaimed, and found to be very productive. There is an evident improvement in the salubrity of the region, — malarial diseases being less frequent, and less severe. — J. S. JOHNSTON.

Louisiana. — There has been no special survey of the swamp lands of this State, but there are known to be more than 3,000,000 acres. I should judge from an examination of S. H. Lockett's Topographical Map of the State, published in 1872, that quite one-tenth of the area of the State is subject to overflow. The system of levees inaugurated at an early period, was before the war measurably successful as a defense from the annual floods of the Mississippi, but no adequate or systematic method of reclaiming the swamp lands of Louisiana has been adopted. There is no State in the Union where the swamp lands are naturally so productive, and which would repay better for draining than those of this State. The levee system is perhaps the only one that gives any promise of their reclamation, and if this is ever accomplished it must be by the General Government. The many reports to Congress, and to the different States bordering on the Mississippi, point to this. These lands are all fertile and capable of producing when drained, any of the crops grown in the Southern States. A large quantity of the sea marsh land, too, is capable of reclamation for rice culture, and small areas are now under cultivation. The salubrity is unquestionably improved by draining, and the value of lands thereby greatly enhanced. — JOHN RAY, *Registrar.*

Maryland. — The area of swamp lands in this State is about 100,000 acres of water-soaked, swamp, and boggy lands, lying chiefly along the Elk, Choptank, Nanticoke, Pocomoke, Patuxent, and Potomac, and about the mouth of the small streams entering the Chesapeake Bay and Potomac River. To these may be added the tide-water marshes. Perhaps the largest area of marsh land is in Dorchester County on the Eastern Shore. No survey of the marsh and swamp lands has been made by the State. It is estimated that about 1,000 acres of this class of lands have been recovered by drainage, but owing to the insufficient methods adopted, the experiment has not proved remunerative. The tide-water has been shut out by embankments in which are gates through which the drainage of the ditches is discharged at low tide, but as the rise and fall of the tide is only from twenty to thirty inches, the fall is not sufficient to effectually drain the low lands. The swamps above tide are effectually drained by ditching, and such lands are found to be very productive. In the summer, the swamp lands are believed to cause malarial diseases. The efforts at redemption have been so limited that it is difficult to state the influence exerted on the value of lands in the vicinity, but it is believed that it has enhanced their value, and rendered them more salubrious. The subject of draining has not engaged the attention of the people to any considerable extent. There has been no report from the State Board of Health, on the influence these swamp lands have upon health, but physicians generally esteem them to be the cause of malarial fevers. Where the swamp lands of Maryland have been reclaimed, they have been found very favorable for the production of corn, vegetables, and grass. — R. C. HOLLIDAY, *Secretary of State* (*for the Governor*).

Michigan. — The quantity of swamp, boggy, and overflowed lands is not definitely known, as no survey of them has been made by the State. They are scattered throughout the State, and are estimated at about 8,570 square miles, of which about 500 have been re-

pleted by the Emperor Claudius to drain Lake Fucinus, now Lago di Celano, about fifty miles east of Rome. This lake is 2,200 feet above tide, and its

claimed, and about 800 more partially reclaimed to agriculture. It is believed that nearly all the swamp and wet lands of the State are susceptible of drainage. The usual method has been straightening streams, removing obstacles, deepening channels, digging large drains as main conduits, with lateral drains of smaller size, underdraining, etc. Such lands, when thoroughly drained, are quite productive, and much enhanced in value; and when adjoining cultivated farms, private enterprise reduces them to an arable state. There is still much unoccupied upland of fine quality in market at a moderate price, so that swamp lands are not sought after as an investment. As early as 1857 the State passed "an Act for the draining of swamps, marshes, and other low lands." This law was amended in 1869, and further amended in 1871, so that now every county is empowered to drain its lands, and, for the expense, to levy an equable tax on the property benefited. Dr. Kidze estimates that there was only one acre of wet or swampy land to nine of dry land. The legislation upon swamp lands has been based on the theory that draining of the wet lands would promote health, and experience serves to corroborate this view. The State Medical Association, and the State Board of Health, are each investigating the influence of swampy and wet lands upon health and mortality. The judgment of the people, and of the rural practitioners, is, that they cause malarial fevers, and their reclamation lessens the percentage of such diseases about seventy-five per cent., though they do not prevent settlers from occupying them as the better lands become cultivated. It is estimated that in the last ten years over 20,000 miles of ditching have been dug in the State, and that no law of the State has been more promotive of the general prosperity of the people than the drainage laws. — S. A. CLAPP, *Census of Land Office;* and H. B. BAKER, M. D., *Superintendent State Board of Health.*

Minnesota. — There has been no survey of the swamp and water-soaked lands of this State, and therefore the amount is undetermined. In the extreme northern central portions which have not been surveyed by the United States Land Office, explorers say there are large areas of uncultivable grass swamps, through which at present horses cannot pass. The State is the recipient of the General Government bounty of the Swamp Land Grant, and has received patents for 1,142,453 acres. This amount does not comprise all the swamp area that the State is entitled to under the grant. From the fact that there are immense areas of fine arable lands unoccupied, and to be obtained at very moderate prices, no special efforts, except in particular cases, have been made to reclaim swamp lands. The reclamation of swamp lands undoubtedly improves their salubrity, and enhances their value. General acts, looking to the recovery of this class of lands, were passed by the Legislature, March, 1873, and further enactments in 1875. — W. P. JEWETT, *Land Office.*

Mississippi. — "There are large tracts of land that are swampy, or subject to overflow — millions of acres, I presume — no exact data obtainable." — JAMES HILL, *Secretary of State.*

Missouri. — It is impossible at present to give the exact quantity of swamp and water-soaked or boggy lands in this State, because they are scattered over nearly all parts, and are in small areas, disconnected, from twenty to two hundred or three hundred acres. In other places there are connected swamps covering many thousand acres. The largest bodies of these are in southern Missouri. In northwestern Missouri are found some of the most noted connected swamps. Lake Torkia, containing about 3,150 acres, is in Township 60 N. of base line. The most prominent swamps in southeastern Missouri are those known as the "Overflow of Little River," covering somewhere about 60,000 acres. "Eastward Lake," "Lake St. John," "Ten-mile and Four-mile Ponds," "The overflow of the Chillitaceaux," "Lake Nic Coony," "Negro Wool Swamp," "Big Lake," "Cooper Lake," "Big Water Lake," and others. Parts of these swamps, to the extent of perhaps 75,000 acres, are being surveyed, but the work can only be prosecuted in the dry season, or in the winter. Many small areas of swamp have been reclaimed by drainage through individual enterprise. The most noted of these was Marais Tenio Clair, in Township 48. This tract, comprising 10,000 acres, was totally covered with water. A drain was cut in the winter and spring, and a good crop of corn raised the following summer of eighty bushels to the

occasional overflow created pestilential exhalations, and caused epidemic diseases which almost depopulated the fine agricultural region between the

acre, and the land produces a good crop every season. A stock company has been formed to drain the swamp known as the Overflow of Little River. This one flow extends about eighty miles in length, with a breadth of from one half to five miles, through the counties of New Madrid, Pemiscot, and Dunklin, all in the southeastern part of the State. This company propose to cut through this a small canal, which shall be navigable for small vessels. The project of draining is entirely feasible, as the fall is thirteen inches to the mile. It is a fact worthy of note that this swamp did not exist prior to the earthquake of 1811, and was caused by the upheaval at some point in the bed of Little River, and thus backing of the water over the adjacent lands. The belief at the time among the settlers was that the land had sunk, but this has been disproven by geological and other scientific examinations. This great body of some of the finest lands in the State is submerged for above three months in the year, and is covered by a dense growth of wild grass, cane, etc., which decays upon the ground. The land, if reclaimed, will make the section valuable, and furnish a soil that will produce one hundred bushels of corn, or a bale and a half of cotton to the acre. When the swamp lands are reclaimed, they are greatly enhanced in value, and also improve the value of land in the vicinity. Public opinion now favors the reclamation of swamp lands both for health and for profit, and legislation gives ample power to the counties where swamps exist, to authorize their drainage and the levying of a tax upon all persons benefited, to cover the cost. — *Register of Lands, Mo.*

Montana Territory. — The quantity of swamp or wet lands in this territory is not known; but they are so small in extent and so widely scattered as to be insignificant. They have attracted little or no attention, consequently there has been no survey or legislation upon the subject. No ill health is suspected as flowing from wet lands in this territory. — A. J. SMITH, *Surveyor-gen. of Territory* (*for the Governor*).

New Jersey. — There are 295,000 acres of tide-water marsh lands in this State, bordering on the Newark Bay, Staten Island Sound, Raritan River and Bay; the sea-shore from Sandy Hook to Cape May, and the border of Delaware Bay and river as far as Camden. There are 10,000 acres of wet land, or land liable to overflow in freshets on the Walkill in Sussex County; 5,500 acres on the Pequest in Warren County; 25,000 acres on the Passaic in Somerset, Morris, Essex, and Passaic counties; 1,600 acres on the Pauluskill in Sussex County, and many tracts of smaller area in other parts of the State. These data have been drawn from the geological surveys; but a special survey of this class of lands has been ordered by the State. Perhaps 25,000 acres of tide marsh have been reclaimed, and sections of variable extent of overflowed lands have been partially reclaimed along the rivers. The marshes in the vicinity of Salem were drained as early as 1700, and from that time to the present have been profitably managed by diking and other measures; 15,000 acres in Salem County alone have been reclaimed. Thus, by straightening of streams, ditching, and banking, nearly the whole area of marsh and overflowed lands can be reclaimed, and the cost of this work will probably not average two dollars per acre!

Such lands, when reclaimed, are more productive than uplands. Settlers are found along the borders of the swamps; but strangers generally fear them on account of the malaria, and in some localities their insalubrity is fully recognized. The reclaimed lands are always enhanced in value, often as much as tenfold. The lands adjacent are also made more valuable on account of improved healthfulness of the neighborhood. It is confidently believed that nearly all the swamp lands of the State can be reclaimed. The Health Commission, that was created by the Legislature, reported in 1874 strongly in favor of the State taking action for the reclamation of swamp and water-soaked lands in the interest of the public health. Many special acts relative to drainage have been passed; but this work is now being done under the law "to provide for the drainage of lands," passed in 1871. The great number of owners, and the difficulty of obtaining harmonious action, along with property rights to water-power and privileges, are found to be retarding the improvements, and thus perpetuate the evils of swamp land, even in thickly settled localities. By the amended law, five property holders desiring to have their lands drained, on petition to the court a commission is constituted to survey and act in conjunction with the State Geologist,

lake and the coast. The construction of a tunnel to lower the level of this lake was proposed as early as the time of Julius Cæsar, but the work was not

and if they consider it feasible the work is ordered to be done, and the cost equally applied to all parties benefited. The interest of the public must control that of the individual, and the State must act as umpire. The individual cannot be permitted to maintain a mill-dam, or carry on a business that abridges or injures the rights of his neighbor. Much interest is now being manifested by the citizens on the question of the reclamation of swamp and water-soaked lands, both from a sanitary and an economic standpoint; and much good is sure to be achieved for the public health in the prompt execution of the work of reclamation of some of the richest lands in the State of New Jersey. — GEO. H. COOK, *State Geologist.*

New Mexico. — This Territory, from its elevation above sea level and ample drainage, has no considerable tracts of land which deserve to be classed as swampy, boggy, or water-soaked. At a few places in the vicinity of springs there are spots of wet land called "cienegas," but they do not possess much commercial or sanitary importance.

New York. — No survey of swamp or water-soaked and bog lands has been made by this State, consequently the area of such lands is unknown. Legislation has been had in reference to such lands. An attempt has been made, but as yet with partial success, though it is believed to be entirely feasible, to drain the Montezuma marshes by the lowering of the outlet of Geneva Lake. In many instances drainage of wet lands has been accomplished by private enterprise, on a limited scale, but no record or statistics of these results exist. The State owns no swamp lands except those in the Adirondac region. Numerous special acts of the Legislature have been passed to enable private enterprise to drain land. A general Act was passed in 1869 to enable owners to drain through adjoining property. This Act was amended in 1870, and again in 1872 and 1873. — T. E. HARRISON, *Agricultural Secretary.* For farther facts see Dr. Elisha Harris's Report on Systematic Drainage for Health in the State of New York, to New York State Medical Society, 1861.

[Long Island (and counties), Staten Island, Manhattan Island, and Westchester County, have an aggregate of 120 square miles of salt marsh and water soaked lands, now nearly useless and generally insalubrious.

The Oneida swamp contains 20,000 acres, the Cayuga and Montezuma contains 60,000, the Madison County swamp about 10,000, the Tonawanda swamps 22,000. These are all lowland swamps and marshes.

The summit or high-land swamps cover nearly 100 square miles. I count the 15,000 acres of Orange County drowned lands in the latter. Thus we find in the beautiful State of New York 390 square miles of swamp and marshes, nearly every acre of which may be completely reclaimed and made useful to man. — DR. E. HARRIS.]

Oregon. — There has been but a partial survey of the swamp and water-soaked lands of this State. It is estimated, however, that their extent will reach a million and a half acres. These lands lie chiefly along the Columbia River.

Wappatoo and La Bish Lakes in Grand Rinde Valley and about the Klamath and Goose Lakes in Southern Oregon, including Klamath Marsh, Thompson's Valley, Summer and Silver Lakes, Warner Valley and Lakes, and Chewanean Marsh. There are also marsh and swamp lands in the vicinity of the sea-coast. There has been no official publication relative to these lands in Oregon.

The quantity of swamp lands as yet reclaimed is limited, but such lands are very productive, and as most of this class of lands lie above tide, are susceptible of drainage. No complaints are made of the unhealthfulness of these swamps, chiefly because these water-soaked and swamp areas are fed by abundant fresh springs. But it has been found that the value of lands in the neighborhood is enhanced when they are well drained. The attention of farmers and speculators is now actively directed to this question of drainage for profit. Every crop and all kinds of pasture are produced profitably on such reclaimed lands.

The Legislature, October 26, 1870, passed an act which refers to the purchase and reclamation of overflowed lands, with a view to encourage enterprise and capital in this direction. The successful reclamation of this class of lands in Oregon is entirely feasible,

begun until the time of Claudius, and it was only made a practical success by Hadrian. Prince Tolanea, at a cost of nearly six million dollars, is bringing

and will add to or insure salubrity, and will give greater area of good cultivable land, and do much to encourage and support a large agricultural population. — L. F. GROVER, *Governor of Oregon.*

Rhode Island. — No accurate survey of the swamp, water-soaked, and boggy lands of the State has been made. The State census of 1865 shows that the salt marshes of the State contain 3,531 acres. Nearly every township in the State contains more or less water-soaked, swampy lands. The largest swamp in the State is known as the "Great Swamp" in South Kensington, which is said to contain about 1,500 acres. The reclamation of the swamp lands has been carried on to some extent, and with measurably good results. The quantity of such reclaimed lands cannot be given; it is probably small. The fact that the reservoirs of water are of importance to the mill interests, controls even the question of drainage. But fortunately malarial fevers are not traced to these swamps, nor does popular opinion assign to them any unfavorable influence upon health. Experiments for the reclamation of these lands have been made and reports of the results have been published in the *Transactions of the Society for Domestic Industry* for 1850, 1851, and 1855. The reclaimed lands so far, have been found to be very productive, and the redemption undoubtedly enhances their value, and that of the adjacent lands. An Act was passed by the Legislature in 1874, looking to the redemption of all or any of this class of lands in the State. The whole area of the swamp lands of Rhode Island would probably not exceed 20,000 acres. — J. S. PITTMAN, *Secretary.*

Pennsylvania. — This great State has not furnished any data upon which to form an estimate of the extent of swamp and boggy lands within her territory. The Hon. William McCandless writes for the governor that the Department of State does not possess the information. It is known that in some of the counties considerable tracts of this character of lands exist, which if reclaimed would improve the value and conserve the public health. As these notes are all made up from briefing or correspondence on the subject with the governors of the States and the Agricultural Department, I shall not supply facts from other sources available to all students.

South Carolina. — As no survey of this class of lands has been made, no exact data exist in any of the departments of the State; the information furnished by Gov. D. H. Chamberlain will give an approximate estimate derived from those best informed on the subject.

The area of swamp lands is estimated to be between five and six millions of acres. Many of the swamps are designated by local names. There has been perhaps 35,000 acres of this land reclaimed to cultivation, with success where the methods pursued were suitable and properly executed.

Individual efforts only have been evoked in this enterprise. No general or State system has been devised; — embanking and ditching, such as each farmer thought proper to execute, and looking only to his own interest. The swamp lands are esteemed unfavorable to health. Reclamation by draining is considered to improve the salubrity and increase the value of the lands in both a commercial and productive way. Attention is being drawn to the subject of drainage, but it has not yet assumed a practical form. Obstructions and dams to the courses of streams have been removed, with a view to improve the public health. The reclaimed lands are best suited for the production of rice and corn. — D. H. CHAMBERLAIN, *Governor.*

Tennessee. — No survey of the swamp, water-soaked, and boggy lands of the State has been made. It is estimated (there are no statistics) that there are about 185,000 acres of swamp and boggy lands, independent of the permanent lakes fed by springs which do not become stagnant. Reelfoot Lake in Obion County is eighteen miles long, and has a width of from a half a mile to three miles, and abounds in a variety of fish. This lake did not exist previous to the earthquake of 1811–12. Its existence is due to the filling up of a portion of the channel of Reelfoot Creek by the convulsion of the earth at that time damming up the water, and preventing its free exit to the Mississippi. Haywood County also has a number of lakes well stocked with fish. Perhaps one tenth of the water-soaked and boggy

this engineering project to a successful completion. The land he has already reclaimed to salubrity and agriculture affords a livelihood for sixteen thousand persons, and it is said when the work is completed the lands recovered

lands, given in the above estimate, have been reclaimed by private enterprise. There has been no special legislation looking to the reclamation of this class of lands. Chills and fevers prevail in the vicinity of such swamps. And it is well established that the salubrity and value of lands is enhanced when thoroughly drained, though good lands are so abundant that the influence of drainage on surrounding property is not apparent. The largest body of overflowed lands lies along the Mississippi River, in the counties of Lake, Dyer, Lauderdale, Tipton, and Shelby. These embrace about four hundred thousand acres, about one fourth of which lies about ten to eighteen miles back from the river, and is in a boggy and marshy condition. Here, as elsewhere in the Mississippi River Valley, the lands just along the streams are higher than those a little further back. This is notably the fact along the moderately large-sized streams, — the Forked Deer, the Obion, the Big Hatchie, the Wolf, and the tributaries all running southeast, and emptying into the Mississippi River. Although there are overflows from all of these streams, still the great want is a levee of the Mississippi River, of sufficient strength to protect the country along its course. The beds of the smaller streams generally are lower than the swamps, and, therefore, drainage of the wet lands along these is entirely feasible. The gum-swamps, where the soil is of an ashy color, are not found to be productive; but in the cypress-swamps, and where the soil is of a dark hue, the reclaimed lands prove very productive of the grasses and small crops. From the Lower Tennessee River to the Cumberland table-lands, the country is well drained; perhaps in all this extent there are not more than ten thousand acres unfit for cultivation, and these are elevated, and can be drained at slight expense. At the junction of the Emory River with the Clinch, south of the first and west of the latter, there is a swamp of about four miles in length, and from one fourth to a half in width. This can readily be reclaimed by ditching. On Lick Creek, in Green County, exists much swamp land, partly wet in winter. The soil has a bluish-yellow appearance, upon which herd's-grass grows luxuriantly. Here some of the farmers have made open ditches, which greatly assist in carrying off the superabundant water. This swamp has, perhaps, four thousand acres. In the swamps of Tennessee, when first drained, the soil is found to be surcharged with acids, probably pyroligneous and humic, but exposure and tillage soon remove these. Some small swamps in the vicinity of the Kentucky line, in the counties of Stewart, Montgomery, Robertson, and Macon, have a soil largely intermixed with a small, hard, black gravel; this soil, when drained, is not found to be sufficiently productive to requite for the cost and labor; but this is of very limited area. The drained lands generally are very productive, and reward the farmer handsomely.

In all of what is known as the Cumberland table-lands, there are not more than 15,000 acres of wet and swampy lands. In East Tennessee, there are no swamps worth mention. The farmers of this State are, of late, giving more attention to draining their lands; and there is a growing confidence in its influence upon salubrity, as well as increased productiveness. — J. B. KILLEBREW, *Com. of Agriculture.*

Vermont. — No separate survey of the swamp and boggy lands of this State has been made. The State Geologist, Hiram A. Cutting, who is quite familiar with the subject, estimates the whole area entitled to be embraced in this class as aggregating 37,500 acres. There are no large swamps. The same person estimates that about 6,250 acres have been reclaimed, which make good meadow land. The modes of reclamation resorted to have been ditching, and changing water-courses. This class of lands is not found to be productive, except for grass. The value of lands is enhanced by the draining of swamps; but this increase of value does not often extend to the adjacent lands. Governor Peck writes that this character of lands, though not existing in any considerable quantity, have attracted some attention, and efforts from time to time have been made for their reclamation. Hence a law was passed, bearing upon the subject, in 1868, and an amended law with increased provisions was passed in 1874. As there is but little stagnant water in the swamps of this State, their reclamation is chiefly with a view to profit rather than to benefit health, although

will give homes and employment to over forty thousand. Its sanitary importance cannot be estimated, though its immense economic value to the state is at once apparent. In the United States we have given as yet less attention to the subject of drainage of water-soaked, alluvial, and overflowed lands than we should, and chiefly because good, dry lands were cheap and abundant. The lands requiring drainage, as we will show, lie chiefly along the coast and in the vicinity of our lakes and at the heads of bays, and along the courses of our larger rivers. The success that has attended engineering in this department of hydraulics in other countries, suggests that we only need earnest and able engineers to insure similar results in the redemption of immense areas of the richest lands in America, and at the same time to promote salubrity and conserve the public health.

The elements — it is observed — air, frost, and running water, are constantly disintegrating and washing down from the mountains, hills, and uplands not only the productive soil, but rock and earth strata, and depositing them in the low lands, or forming deltas and alluvial lands at the mouths of rivers, in lakes, or along the sea-shore. There is not a harbor or seaport city at the mouth of a great river that would not in a few years be filled up so that ships could not reach its wharves except for the constant dredging which is done to remove the fluviatile deposits and the washings from the streets and sewers of the city. Indeed, the tendency of the elevated lands is toward the deep sea. This movement is indicated by the existence of immense alluvial plains and deltas formed from the soil and disintegrated rocks which have been transported to, and have encroached upon the sea at the mouths of the great rivers in different parts of the world.[1]

I have no doubt they do to some extent affect the latter. — HIRAM A. CUTTING, *State Geologist.*

Virginia. — The reply received from the Governor of this State, to the application for information relative to the area of undrained lands, was that "no data exist in any department of the State that would enable him to approximate the area." — JAMES L. KEMPER.

West Virginia. — This State is almost entirely mountainous or rolling, and is well drained by streams of rapid current. The few swamps that exist are so small in area as to attract but little attention, and are not known to have any deleterious influence upon health. Private interests, and individual owners of such lands are gradually draining them for pasture lands. — JOHN J. JACOBS, *Governor.*

[1] *Delta of the Mississippi.* — The Mississippi River, with its principal affluent, the Missouri, is the longest river (4,350 miles) in the world, but not the largest. It drains the vast area between the Alleghany and Rocky Mountains. The headwaters of the Mississippi proper have their origin about 1,680 feet above the sea, on the divide between the Red River of the North and the streams which flow 3,160 miles into the Gulf of Mexico. The sources of the Missouri are among the snow-capped peaks of the Rocky Mountains, and from points north of the forty-ninth degree of north latitude. The average descent of the Mississippi is six inches and a fraction to the mile. The average depth of this river, below the mouth of the Ohio, varies from ninety to one hundred and ninety feet, and the breadth from six hundred to twelve hundred yards. The mean velocity, between the Gulf and the junction of the Missouri, is from sixty to seventy miles a day. The delta of the Mississippi, as given by Lyell, is about two hundred miles in length, with a mean width of seventy-five miles, comprising an area of fifteen thousand square miles. Col. C. G. Forshey includes, in his description of the delta, the alluvial land, the two making 38,706 square miles. The sediment annually brought down by the Mississippi and its tributaries has been estimated to be equal to a deposit of a foot in thickness over twelve square miles.

The examination of this question has led me to collect some data as to the situation, extension, and rate of increase of the principal deltas. Lands

Messrs. Humphrey and Abbott estimate the annual prolongation of the delta at six yards. The whole southern border of the State of Louisiana, says McCulloch, consists either of sea marsh or vast plains, which occupy one fifth of the surface of the State. The whole region about the mouth of the river is one continued swamp. From lat. 32° to 31°, the average width of overflowed land is twenty miles. From lat. 31° to the efflux of La Fourche, the width is forty miles. Colonel Forshey estimates that 3,616 square miles are irreclaimable, but that the reclaimable delta has an area of 35,813 square miles, or about 22,920,320 acres.

The following resolution was passed July 23, 1874, by the Commission of Engineers appointed by Congress "to investigate and report a permanent plan for the reclamation of the alluvial basin of the Mississippi River subject to inundation."

"*Resolved,* That heretofore all cultivation of the Mississippi bottom lands owes its success to the construction of levees, and that this Commission has confidence that the system, properly applied, is adequate to the protection of the country against floods. Whether it should be exclusively trusted, or be combined with outlets, is a matter to be decided by economical considerations" (p. 148, Report).

Delta of the Nile. — That Egypt was the "Gift of the Nile," was the opinion of her priests before the time of Herodotus. He observes that the country around Memphis seemed formerly to have been an arm of the sea, gradually filled up by the Nile. Egypt, therefore, he says, like the Red Sea, was once a long narrow bay, and both gulfs were separated by a small neck of land (Lyell). This celebrated river, taking its rise in the mountains of the Moon at an elevation of 15,000 feet, flows through two main streams, the Blue and the White rivers. The former has its source in lat. 15° 37′ N., long. 36° 50′ E., and the latter is said to rise on the Gomberat Mountains. After running through intermediate marshes, jungles, and desert waste for 3,000 miles, it discharges its waters and sediment into the Mediterranean by two mouths, the Rosetta and Damietta. The average velocity of the Nile, in Egypt, is, from Asswan to the sea, three miles per hour. For about six hundred miles the region is subject to overflow, the average fall being three inches per mile, and the current slower. The delta in its greatest breadth is eighty-five miles from east to west, and the distance from its apex to the sea is rather more than ninety miles, and includes an area of 8,600 square miles. Great changes have taken place along the delta in the lapse of ages; the soil has not only been elevated many feet by alluvial deposits, but its accretion has altered the coast line within the historic period. If the advance of the alluvial deposits was not more rapid during past ages than it is at present, it must have taken the Nile no less than 74,253 years to deposit, grain by grain, its triangular plain or delta, comprising an area of 8,610 square miles. The advance of the shore line, it is estimated, averages two feet annually. The whole delta is exceedingly productive, and, strange as it may seem, although subject to overflow, still, during the dry season, it requires irrigation to secure a crop.

The Delta of the Ganges. — The River Ganges has its sources in the central chain of the Himalayas at an elevation of from 13,000 to 18,000 feet above the sea; but from Hurdwar, nearly at the foot of the Himalayas, — a distance of about 1,200 miles, — the fall of the river to the mouth is only one thousand feet. The total length of the river is estimated at 1,960 miles. The delta begins two hundred miles from the sea, and is from eighty to two hundred miles in breadth. That part of the delta bordering on the sea, known as the Sunderbunds, is a dreary, unhealthy region, covered with wood, and broken up by numerous creeks and rivers, all of which are salt, except those that immediately communicate with the principal arm of the Ganges. After the rains have become general, the river rises to a height of thirty-two feet above its ordinary level; and by the end of July all the flat country of Bengal, contiguous to the Ganges and Brahmapootra, is overflowed to an extent in breadth of one hundred miles. The quantity of water discharged into the ocean by the Ganges is computed to be 500,000 cubic feet per second, in the four months of the flood season, and 100,000 for the remainder of the year. The quantity of mud brought down annually is computed to be 235,521,387 cubic yards, and it discolors the sea to a distance of

formed in this way are almost everywhere fertile when above high tides, or when reclaimed from semi-overflowed swamps and water-soaked conditions.

sixty miles from the coast. Major R. H. Colebrook, cited by Lyell, states that such is the looseness of the soil that the Ganges, in excavating a new channel, in one instance, carried away forty square miles in the course of a few years.

The Delta of the Euphrates. — The Euphrates, the most considerable river of Western Asia, rises in the table-land of Armenia, and flows generally parallel to the Tigris in a southeasterly direction. In lat. 31° 0′ 28″ N., and long. 47° 40″ E., it unites with the latter to form the Shat-el-Arab (River of Arabia), which discharges its waters into the head of the Persian Gulf. The basin of the Euphrates, exclusive of that of the Tigris, is supposed to comprise about 109,000 square miles. The river is formed by the junction of the Frat and Morad. The former, the most northern, has its principal sources in the Tcheldir Mountains, about 5,000 feet above the sea; the latter has its sources on the northern declivity of the Arghidagh Mountains. The united stream flows southwest, and forces a passage through the main range of the Taurus mountains. The length of the Euphrates, estimating from the source of the Morad, is 1,800 miles; its average breadth is about two hundred yards, and its depth from twelve to thirty feet. The extent of land covered by the deposits of the Euphrates and Tigris is about 32,000 square miles. The velocity of the current of the Euphrates is from two to four miles per hour, and the amount of water discharged from its mouth is 236,907 cubic feet per second. The increment of land about the delta has been found to be a mile in thirty years, — about double the increase of any other delta in the world.

Delta of the Amazon. — The Amazon, the principal river in South America, and probably the largest, though not the longest river in the world, has its origin in the Andes in Peru, flowing 4,000 miles. It drains an area estimated at 2,500,000 square miles, and empties into the Atlantic 130,000 cubic yards per second. It flows from Jaen, which is 1,240 feet above tide-level, with a current varying from 1 to 3.7 miles per hour. When the river overflows, it covers the marshes on its banks, forming a perfect sea of one hundred and eighty miles in width. The tide is perceptible at Abidos at the full of the moon, four hundred miles inland. The phenomena of the bore tides or waves occur in this region. Such is the volume and impetus of this stream, that it carries all its waters unmixed into the sea to the distance of above eighty leagues (Lippincott). The breadth of the largest mouth, according to the *Imperial Gazette*, is ninety-six miles; but the two arms, with the island included, cover a width of perhaps two hundred and fifty miles. Although the delta has not encroached much on the coast linė, the area of alluvial deposits is large, and it is very fertile.

The Delta of the Orinoco has its apex one hundred and thirty miles from the sea. It is a large river rising in the Sierra Venezuela and emptying into the Atlantic Ocean and the Gulf of Paria through many mouths. It has a navigable channel communicating with the Rio Negro, and also with the Amazon. The tide reaches to Angostura, two hundred and fifty miles from the sea, and has a width here of four miles. For five hundred miles before emptying into the sea, there are extensive swamps with much rich pasturage. At certain seasons, the floods cover the flats for many miles in all directions.

The Delta of the Po. — The River Po has its sources in the Alps, and carries down to the Adriatic the earthy matter poured into it by a multitude of tributaries, loaded with the denudation from the high lands. The deposit of this fluviatile material has effected great changes in the plains of Italy since the time of the Roman Republic. Along the shores of the Adriatic, from the northern part of the Gulf of Trieste, where the Isenzo enters, down to the south of Ravenna, more than one hundred miles there is an uninterrupted accretion of land, which, within the last two thousand years, has increased from two to twenty miles in breadth. It is calculated that the mean annual rate of advance of the delta of the Po upon the Gulf was, from the years 1200 to 1600, about twenty-five yards. From 1600 to 1804, it averaged, according to Lyell, seventy-six yards annually. The city of Adria, now over twenty Italian miles from the Gulf, was, in the time of Augustus, a seaport of much importance. The city of Ravenna, once a seaport, is now, owing to the accretions of the land, four miles from the sea. This is also true of the ancient city of Spina, and other

Whether or not the American people recognize at this time the necessity or importance of reclaiming the swamp lands of the United States to agriculture

places, once seaports but now far inland. In order to check the inroads made upon the alluvial lands by the rivers along their course, a system of embankments were erected along the Po, Adige, and most of their tributaries, and they have been kept in repair for many centuries.

The Delta of the Danube. — The Danube originates in two small streams, which rise on the eastern declivity of the Black Forest and Carpathian Mountains, at an elevation of 2,850 feet above sea level. The distance from its source to its mouth is about 1,800 miles, and including its windings 2,423 miles. It is navigable at Ulm for small boats. The delta of the Danube is a vast, swampy flat, interspersed with lagoons encroaching slowly upon the sea, and which are gradually filling up and becoming reclaimable (McC.). The river discharges itself through five mouths into the Black Sea, and its water is distinguishable in the latter at a distance of forty-six miles.

Delta of the Rhine. — The Rhine rises on the north side of the Alps, and flowing through Switzerland and Germany falls into the North Sea or German Ocean. It is nine hundred and sixty miles long, and has an area of basin or drainage, including tributaries, of 83,298 square miles. The sources of the Rhine are near those of the Rhone in the Alps, at an elevation of 6,581 feet above the sea. The delta is the largest in Europe, indeed, the rich alluvial lands of the whole of Holland are the gift of this stream, whose mouths extend, with their ramifications, one hundred miles along the coast, from the eastern shore of the Zuyder Zee to the south branch of the Maas; the distance from the base to the apex of the delta being seventy-two miles, and the total area within its limits 4,150 square miles. The mean descent of the river from Strasburg is estimated at one and three-tenths feet per mile, and the current may average somewhat more than three miles an hour.

Delta of the Volga. — The Volga, the largest river in Europe, rises in Lake Seligher on the plateau of Valdai, in lat. 57° N., long. 33° 10′ E., at an elevation of five hundred and fifty feet above the sea. The extent of its basin, including tributaries, is estimated at four hundred thousand square miles, and, including its windings, its course is 2,500 miles, during which its entire fall, where it empties into the Caspian Sea, is 633 feet. The head of the delta is one hundred miles from the sea. It discharges itself by sixty or seventy mouths. The Caspian Sea is eighty-three feet below the level of the Indian Ocean (Lipp.).

Delta of the Rhone. — The Rhone rises in the Pennine Alps, the highest source being on the west side of Mt. St. Gothard, at an elevation of 5,780 feet above the sea. It is five hundred and ninety miles long. The river passes through Lake Lehman, and enters France through the Jura mountains. Its fluviatile matter is filling up Lake Geneva. The estimated area of its basin is 37,300 square miles. The Rhone enters the Mediterranean by four mouths, the first separation occurring at Arles, where two branches are formed, the Great Rhone and the Little Rhone, enclosing the alluvial island of Camargue, which has an area of 1,900 square miles. The Rhone has a rapid course, and brings down a whitish sediment, discoloring the Mediterranean to a distance of six or seven miles.

Delta of the Indus. — The Indus rises on the north side of the Cailas (of the Himalayas). Its total length is estimated at 1,650 miles. The Indus enters the sea by a great number of mouths. The head of the delta is near Tatta, and extends from there to the ocean at Hyderabad and Kurrachee, being about one hundred and thirty miles in length and breadth. The source of the Indus, in the Himalaya range, is supposed to be 18,000 feet above the sea. At Attock, 940 miles from its mouth, where it is 1,000 feet above the ocean level, it is 800 feet across, 60 feet in depth, and has a current of six miles an hour.

Delta of the Niger. — The Delta of the Niger is in the Gulf of Benin, and commences about eighty miles from the sea, and is two hundred and forty miles in extent along the coast. The whole surface is low, flat, and swampy, but affords good pasturage for cattle, and is tilled for rice, millet, and maize. The tide extends up the river about one hundred and thirty miles.

Delta of the Hoang Ho. — The river Hoang Ho rises on the table lands of Central Asia, flows 2,000 miles, and empties into the Yellow Sea, through ten or more mouths, forming a delta, which is estimated to extend over at least 96,000 square miles. This area of alluvial

as an economic measure, if not for sanitary reasons, there is certainly a time approaching in the near future when such lands will be required to support the rapidly increasing population of our country. History teaches that the cultivated uplands in all parts of the world are constantly becoming impoverished and yearly less productive, or are kept fertile only by an enormous expenditure of labor and means. I believe it would be in the true interest of the whole country — and I therefore suggest that the Legislatures of the several States be asked — to authorize commissions to make accurate surveys within their respective territories of all marsh and occasionally overflowed and water-soaked lands along the Atlantic and Gulf coast, as well as those along our lakes, and particularly throughout the Mississippi Valley, with a view to the establishment of a comprehensive system of efficient drainage and the reclamation of the land to salubrity and occupation.[1]

The alluvial lands of the Mississippi are the most remarkable and valuable in the world both for extent and richness. They are at present almost worthless, on account of the frequent overflow from defective levees and

land constitutes one of the most important agricultural provinces in China. The depth of the Yellow Sea, it is stated, has very sensibly diminished about the mouth of the Hoang Ho River, from the annual alluvial deposits. The delta of this river is composed entirely of river sediment.

Delta of the Tiber. — The Tiber, rising in the Tuscan Appenines, after flowing one hundred and eighty-five miles, enters the Mediterranean, seventeen miles below Rome, by two mouths, which inclose a small delta partly reclaimed for agricultural purposes. This was the Insula Sacra of the ancients, described as a pestiferous tract. The Tiber at Rome is but about three hundred feet wide; the waters during flood tides carry with them great quantities of mud, which is deposited at the mouth of the river.

Delta of the River de la Plata. — The Rio de la Plata is a great river of South America, or an estuary into which pour its gigantic tributaries the Parana and the Uraguay. It is more than 2,500 miles in length, and in many places more than six miles in width. It measures at the outlet 170 miles across, and occupies an area of 15,400 square miles. The muddy waters of the river can be traced in the ocean two hundred miles from its mouth, gradually filling up the Gulf of Buenos Ayres with alluvial deposits.

[1] *The Zuyder Zee.* — The question of draining the Zuyder Zee has been mooted, and it is probable it may yet be accomplished by the engineering skill of the future, as the demand for cultivable land increases.

In 1853, the Government of the Netherlands finished the draining of Lake Haarlem, which formerly covered an area of 45,000 acres.

Much swamp land in Hungary has been drained within the last hundred years, and more than half a million acres of swamp has been converted into fertile land by this work.

New Jersey is remarkable for its cedar swamps. They occur in all the counties south of Monmouth, but are most extensive in Cape May and the adjoining counties, — Atlantic and Cumberland. Prof. G. H. Cook, State Geologist, says, a swamp of sixty years' growth will yield from four thousand to seven thousand split rails, — halves and quarters, — and also states that between one and two million acres of land are unimproved in consequence of soil-saturation, and only awaiting the investment of capital in drainage. Millions of dollars have already been — according to Professor Cook — invested in reclaiming and improving the swamp lands of New Jersey.

Prof. J. C. Booth, in his geological survey of the State of Delaware, 1844, stated that there were about one hundred thousand acres of Delaware marshes; but a large portion of this area has since been reclaimed by diking.

In Ireland, extensive peat bogs have been drained and converted thereby into arable territory. Much alluvial land along the rivers and shores of the estuaries of southern Ireland has been rendered cultivable by art.

from the pestilential miasmas these floods create. Even in sections where the high waters have not destroyed the improvements, the lands are often rendered so unhealthy by adjacent swamps that they cannot be cultivated or inhabited. The extent of these lands from Cape Girardeau in Missouri to the Gulf of Mexico is, in a straight line, about 600 miles, with a variable width of from thirty to ninety miles, thus giving for the whole length an average width of sixty miles.[1] If it is possible for engineering skill to drain these lands and protect them from overflow I believe it will yet be done. This accomplished, their salubrity will follow, and their fertility, which is unequaled in the world, will attract to them a dense population. And thus their sanitary condition, their economic value, and their producing capacity will all be established. The reclamation of wet and boggy lands by drainage has doubtless been practiced from very early ages, and it is probable that the measure will ere long assume economic, geographical, and sanitary importance in our country. It is held to be one of the first duties of rulers to so administer the affairs of state as to preserve the soil of the country in a salubrious and productive condition, and if possible to increase the area of their cultivable land. The *necessity* for drainage can be pointed out by the hygienist, and its successful execution and effectiveness can be approved, or its failure condemned by the sanitarian. But the methods and the art of drainage and irrigation properly belong to the engineer.

The mode of drainage by means of the straightening of channels, building dikes, cutting canals, planting trees, and by other means, will suggest itself to all of us, but each particular marsh, swamp, and boggy locality requires special combinations of new and old methods that will at times tax the ability of the ablest engineers.

Mr. Marsh, in his work already referred to, says that within the past century more than half a million acres of swamp land have been recovered by drainage in Hungary, and that many thousands of acres have been reclaimed in Italy, Holland, and China and other countries. The United States Agricultural Report for 1872 gives very encouraging accounts of the reclamation of swamp lands in California[2] by the construction of levees and by other methods.

[1] *Delta of the Mississippi*, by Colonel C. G. Forshey.

[2] The efforts of the people of ancient times to reclaim swamp lands must have been numerous and successful. The inhabitants of Ancient Rome, Greece, Phœnicia, and Tyre, created many works for the protection of the coasts from overflow from the sea.

In our own country, when the city of New Orleans was laid out in 1717, levees were immediately commenced, which were extended in ten years afterwards fifteen or twenty miles up the river; and thus the plan of the levee system of Lower Louisiana was inaugurated. The whole of the embankments of the Mississippi River, and its tributaries, must altogether reach a total length of at least 2,500 miles. At the beginning of the war, on the right bank of the river, from Cape Girardeau to Point-a-la Hacha, below New Orleans, the embankments formed a wall 1,125 miles in length, only interrupted by the mouths of rivers and a few spots of rising ground. In 1828, the levees of the Mississippi were continuous from New Orleans to Red River, and, by 1844, they were complete as far as Napoleon, Ark. After the swamp-land grants of 1849–50, these works were nearly completed from Cape Girardeau, Missouri, to Point-a-la Hacha, below New Orleans.

From neglect, and the frequent crevasses, much of the territory which had been reclaimed

Water-soaked lands are refrigerating in their nature through the evaporation that is constantly taking place, while well-drained lands are warmer on account of their great absorption and retention of heat. The latter will, in consequence, produce better matured fruits and crops than if damp and moist. Drainage, both for sanitary purposes as well as for agriculture, ought to be deep enough to be below the point affected by the ordinary variations of temperature, and that to which the roots of plants extend.

Fortunately, in many places improved modes of agriculture are doing much for health. It is well known to farmers that dry uplands escape the late spring and early autumnal frosts, while the low and wet lands suffer.

Closely connected with drainage, for agricultural purposes, is irrigation.[1]

has again passed into swamp, and neither the people nor the States along the river are now able to bear the expense of repairing and keeping the levees in order.

In England, as many as 680,000 acres of the fen or marsh country have been reclaimed, and the works for this purpose rival those of Holland. A great part of the county of Lincolnshire, England, lies below the level of the sea, from which it is defended by embankments, and thus rendered arable. Since the occupation of the county by the Romans, large tracts have from time to time been reclaimed. The soil of these lands is the finest in England. In the third century the Emperor Severus built a road from Peterborough to Denver, which was sixty feet wide and three feet deep. It is now covered by from three to five feet of soil, and is protected from the sea by an embankment. There is much reason to believe that Bedford Level, a district of England having an approximate area of 400,000 acres, was formerly much lower than at present, and was covered by a vast forest.

The Lowlanders are believed to have secured some coast and bay islands by ring-dikes, and to have embanked some fresh-water channels, as early as the eighth or ninth century; but it does not appear that sea dikes, important enough to be noticed in historical records, were constructed on the main land before the thirteenth century. The practice of draining inland accumulations of water, whether fresh or salt, for the purpose of bringing under cultivation the ground they cover, is of later origin, and is said not to have been adopted until after the middle of the fifteenth century. (Marsh refers to Staring, p. 407.)

The dike system of Holland is perhaps the most remarkable and perfect in the world. It has redeemed to agriculture an immense area of rich alluvial land. The works are constructed to reclaim the deltas and alluvial deposits of the Scheldt, Meuse, and Rhine, and are kept in repair at an annual expense to the government of from $2,000,000 to $2,500,000. Staring estimates the whole surface gained to agriculture in the Netherlands at 877,240 acres, which was accomplished by diking against the sea, and by drainage. Between 1815 and 1858 more than a hundred thousand acres were added to the agricultural industries.

Denmark is a low, flat country, and some parts of its northern portion are below the level of the sea. The whole western coast of Holstein Sleswick is defended, as in Holland, by dikes or mounds, erected against the waves of the Baltic Sea. Zealand is protected by dikes 250 miles long, maintained at an annual cost of over $400,000.

The island of Pelworm, on the coast of Sleswick, having an area of 10,000 acres, expends annually $30,000 for the maintenance of its dikes. The Adour, which, however, does not carry down such large quantities of alluvium as the Mississippi and the Rhone, is one of the few rivers where engineers have obtained at least favorable results from the system of embankment. Commenced as early as 1694, the labors of the engineers have continued up to the present time. To check the rivers of Italy from deviating from their courses and invading the lowlands, a system of artificial embankments has been adopted. The Po, Adige, and almost all their tributaries, are now confined between high artificial banks.

This practice, Lyell says, was adopted in Italy as early as the thirteenth century. Newark Meadows, in the State of New Jersey, have been to some extent embanked, and will yet, I have no doubt, be drained, and become arable and salubrious.

[1] The art of irrigation, it would seem, was known and extensively practiced by the ancients. The earlier operations of this nature, of which there are remains, are found on the

Both of these are very ancient. It is stated that since the completion of the Suez Canal the amount of rainfall in the isthmus has increased. This result is also claimed by the Mormons in Utah, as the consequence of the planting of trees, and irrigation for agricultural purposes. The introduction of the eucalyptus has raised the hope that this tree will grow upon our western plains, and on what have been denominated the American deserts. The belief is entertained, whether based on scientific principles or not, that if the great American plains were clothed with timber, a more abundant and equable precipitation would follow, and that this would lead to the profitable occupation and cultivation of this immense region.

The apprehension that sufficient water for agriculture and domestic uses cannot be had on the plains, except along the spurs of mountains, scientific investigations have nearly dispelled. Artesian wells, when sunk in this region, furnish abundance of water at a depth of less than 1,000 feet. Indeed, it is found that the great water currents and rivers under the earth are comparatively near the surface, or within a few thousand feet. Borings have been successful at a greater depth, but this does not invalidate the rule.

I ought perhaps to say a word in apology for the extended remarks I have made on drainage in the interests of sanitary science, and its economic and geographic advantage to the nation. I look upon a proper encouragement of agricultural pursuits, and their regulation and advancement by the fostering care of the government, as of vital importance to the whole people. Indeed, I regard this branch of industry as the fundamental promoter of both the individual and public health, as well as of national prosperity. My judgment is that improvement would follow both in the moral and physical condition of a multitude of our people, if they could be induced by favorable legislation, or other means, to acquire and live in their own houses, and have a garden to cultivate. We regret the contempt or dissatisfaction with which

plains of Central Asia, in that region to which tradition points as the cradle of the human race! In the deserts of Assyria, Mesopotamia, and indeed almost throughout Asia Minor, in Mongolia, Hindostan, and on the banks of the Nile, the remains of these ancient, crude engineering operations are found. In the dawn of the Middle Ages, when the barbaric hosts overran Europe, they, too, brought the arid lands under cultivation by means of irrigation. In the days of King Solomon, on account of the custom being general, Judæa was a fruitful land, and no doubt presented a very different aspect from what it does at the present time, as far as productiveness is concerned. In Lombardy, in the summer, Marsh states, that there are 1,375,000 acres irrigated, requiring daily 60,000,000 cubic yards of water. In 1856, in the former kingdom of Sardinia, including Savoy, 600,000 acres were irrigated during the summer season. The irrigated lands of France are about 247,000 acres. In Italy 2,000,000 acres are irrigated, one half of which is effected by canals.

Irrigation is a necessity in the Oriental countries, where numerous remains of this class of improvements are yet to be seen. In British India it is estimated that there are 6,000,000 acres annually irrigated, and canals are being constructed, that will, when completed, irrigate as much more. In Egypt, the cultivated soil that is annually irrigated amounts to 7,000 square miles, — about 4,500,000 acres. Irrigation for agriculture is not much practiced in the United States, except in the rice fields of the South, and to a limited extent in Colorado, New Mexico, Utah, and California. It is practiced, however, by truck gardens near all our large cities in all the States, and is the only means of producing with certainty first-class garden vegetables in quantities sufficient to render the business profitable.

the small farmer is regarded by a very large portion of our people, who seem disposed to fly from the slow but sure development of the wealth which has been hidden in the soil, in order to attempt the accumulation of rapid fortunes in the marts of manufacture and commerce.

The domain of Preventive Medicine which invites attention is so extensive, that it is quite possible, out of the multitude of points deserving review, that I have not selected either the most important or entertaining. Yet, whatever may be my shortcomings in this regard, I am quite confident they will be compensated by the great treasures which have been stored up, and are now about to be opened to us by the Nestors of sanitary science whom I see around me. My judgment and all my sympathies are earnestly enlisted in the success of this Association, and its efforts to increase the comforts, to improve the vigor and physical condition, and to insure the longevity of our people. Whatever we can do will always be cheerfully done for giving full effect to measures for the preservation of the public health.

Gentlemen, I must plead the importance of my theme in extenuation for the time thus occupied, and in conclusion I feel justified in pledging health, vigor, and long life to the true followers of the Gospel Hygiene.

REPORT OF COMMITTEE ON THE PLAN FOR A SYSTEMATIC SANITARY SURVEY OF THE UNITED STATES: WITH REMARKS ON MEDICAL TOPOGRAPHY.

By JOHN S. BILLINGS, M. D., U. S. Army, Washington,
Chairman of Committee.

SUBMITTED AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 10, 1875.

The Committee appointed at the last meeting of this Association, "to prepare schedules for the purpose of collecting information with regard to the present condition of Public Hygiene in the principal towns and cities of the United States, and the laws and regulations, State and municipal, relating to the same, and to report at the next annual meeting," consists of twenty-four members.[1]

The plan pursued was to assign to each member of the Committee a branch of the subject, upon which he prepared a list of questions. These lists were then printed, and a copy of all of the printed lists was furnished to each member of the Committee, with a request for additions, corrections, and modifications. The lists were also submitted to two or three gentlemen not on the Committee, but who are known to be interested in the subject, and some valuable suggestions were obtained from them, and especially from Dr. A. A. Woodhull, United States Army, to whom thanks are due for his assistance. The lists with the corrections and additions having been returned, a fresh list was prepared, to include as far as possible the suggestions offered, and this list I have the honor to present to the Association as the result of the labors of the Committee. I take especial pleasure in stating that the members of the Committee have given time and attention to the subject, so that the schedules presented fairly represent the opinions of all the members. The question has of course arisen in the committee as to what should, or what can, be done towards obtaining

[1] The list of this Committee is as follows: —

Doctor John S. Billings, Chairman, Washington, D. C.
Dr. H. B. Baker, Lansing, Mich.
Dr. A. N. Bell, New York.
Dr. Francis H. Brown, Boston, Mass.
Dr. S. C. Busey, Washington, D. C.
Dr. Wm. Clendenin, Cincinnati, Ohio.
Dr. Jerome Cochran, Mobile, Ala.
Dr. Josiah Curtis, Washington, D. C.
Dr. N. S. Davis, Chicago, Ill.
Hon. John Eaton, Commissioner of Education, Washington, D. C.
Dr. B. E. Fryer, Surgeon, U. S. Army.
Dr. Elisha Harris, New York.
Dr. E. Lloyd Howard, Baltimore, Md.
Dr. Ezra M. Hunt, Metuchen, N. J.
Dr. John L. LeConte, Philadelphia, Penn.
Dr. Thos. M. Logan, Sacramento, Cal.
Dr. F. Peyre Porcher, Charleston, S. C.
Dr. F. W. Riley, Surgeon, U. S. Marine Hospital Service.
Dr. John H. Rauch, Chicago, Ill.
Dr. Edward Shippen, Medical Inspector U. S. Navy.
Dr. J. A. Steuart, Baltimore, Md.
Dr. Stephen Smith, New York.
Gen'l E. L. Viele, New York.
Dr. C. B. White, New Orleans, La.

answers to these schedules. A few enthusiastic, hard-working, self-sacrificing men, who are willing to undertake any labor which they think will advance science and civilization, and who judge others by themselves, think that the association should at once begin the collection of data. In favor of this it may be observed that for the larger cities, where the collection of these data would be most difficult, the work has been already largely done, and is in print in the shape of Municipal Reports. On the other hand, some of the members of the Committee, who have had some personal experience of the difficulty of obtaining answers to questions which call for what a man knows, and not what he thinks, and who appreciate the fact that men do not usually work without some sufficient inducement, believe that it would be useless to undertake the task, fearing that it would fail as similar attempts have failed before. Whether the Association may decide to attempt to make any immediate use of the schedules, or not, it is hoped and believed that they will be found of interest and value as suggesting subjects for investigation by public health authorities. The schedules are much more full and go much more into details than those issued by the American Medical Association, or those presented by Dr. John Sutherland[1] and agreed to with but slight modifications by the International Statistical Congress at its meeting in London in 1861.

[1] A proposal for a uniform scheme of sanitary statistics was presented by Dr. John Sutherland, at the fourth session of the International Statistical Congress, held in London, in July, 1860, which will be found, as amended after debate by the section, on page 276 of the Report of the Proceedings of that session, 4°, London, 1861.

"1. Statistics of mortality, sickness, and causes of mortality, arranged according to age, sex, class, and occupation. To include not only entire towns, but districts of towns, such as wards, arrondissements, and also streets, blocks of houses, culs de sac, courts, and the like.

"2. The same as regards local charitable institutions, hospitals, poorhouses, schools, common lodging-houses, and the like.

"3. The local climate to be tabulated, and with certified meteorological instruments.

"4. The geological formation, soil, and facility or otherwise of drainage.

"5. The area covered by connected houses, whether comprehended or not within the limits of the administrative or civic authorities.

"6. The length of a line inclosing this area.

"7. The amount of space occupied by buildings, and the vacant area, such as squares, streets, places, and the like.

"8. The length of streets —

(*a*) Drained; (*b*) undrained.
(*c*) Paved; (*d*) unpaved.

"9. The breadth of streets, with the general height of the houses to the top of the roof.

"10. Number of houses.
Number of flats or stories per house.
Number of rooms per house.
Number of sleeping-rooms, with the cubical contents of each.
Number of families, and of inmates.

"11. Character of houses as to —
(*a*) Repair.
(*b*) Cleanliness.
(*c*) Ventilation and light.
(*d*) Healthiness.
(*e*) Water-supply.
(*f*) Underground apartments used as dwellings, with the number of inhabitants in each.

The schedules of questions prepared by the committee of the American Public Health Association are intended to apply to cities and towns of 5,000

(*g*) Number of houses drained into a sewer.
Number of houses having water-closets.
Number of houses having cesspools.
(*h*) Number of windows opening to the front and rear of the house.
(*i*) The cubic contents of schoolroom, the greatest number of scholars, and the means of warming and ventilation.

" 12. Supply of water to the population, and its source from —
(*a*) Rivers.
(*b*) Lake.
(*c*) Shallow wells.
(*d*) Springs.
(*e*) Waterworks.
(*f*) Tanks for rainwater.

" 13. Annual proportionate consumption in the town of —
(*a*) Food.
(*b*) Drinks, with their kinds.

" 14. Classification of Trades —
" *First Division.* — Trades and occupations, as to their effects on the individuals themselves.
I. Persons of rank or property, including manufacturing and trading capitalists.
II. Persons in learned professions, and persons practicing superior arts.
III. Persons actually engaged in the defense of the country, specifying rank and particular occupation.
IV. Persons engaged in the mercantile marine, or otherwise, on the sea, rivers, or canals.
V. Individuals personally engaged in occupations, trades, businesses, and manufactures, or others not embraced in former sections.
(*a*) Involving severe or moderate bodily exertion, or the reverse.
(*b*) Carried on in the open air, or in shops, warehouses, offices, or other confined places.
(*c*) Involving exposure to vapors or miasmata of any kind, or to any kind of dust (including all those usually deemed unhealthy from these causes).
(*d*) Involving the maintenance of a constrained position, or any local pressure.
(*e*) Involving an unusual amount of exposure to the weather, to heat or cold, or sudden alternations of heat and cold.

" *Second Division.* — Trades and occupations, as to their effects on the surrounding population.
I. Trades and occupations occasioning "nuisance, injury to health, or noise."
II. Trades occasioning neither of these.
III. Trades, the nuisance, injury to health, or noise of which can be removed or sufficiently diminished by suitable precautions.
IV. Trades, the nuisance, injury to health, or noise from which cannot be sufficiently diminished by any precautions.

" 15. Interments, their cost, and costs of sickness.

" 16. Statistics of health, sickness, and mortality in the several orders of schools.
(*a*) Results of whole and half-time teaching on the physical and intellectual energies of the young previous to mature development.
(*b*) Results of special gymnastic exercises — as boat rowing, drilling, cricket, football, quoits, and such like.
(*c*) Results of gymnastic exercises as practiced by various classes in Sweden.
(*d*) Topographical site and construction of school and class rooms, their drainage, ventilation, and light; and also the cubic breathing space of the dormitories, in relation to the number of boys or girls sleeping therein.
(*e*) The extent and character of the playgrounds and covered sheds for exercise in wet weather."

inhabitants and upwards, and there are about 325 such cities in the United States.

If it is desired to extend the work to smaller towns, or, as some members of the committee suggest, to counties, the schedules are so framed as to permit of so doing with but slight modifications.

It is unnecessary to enlarge upon the interest and value which the information called for by these questions would have, if collected with any reasonable degree of completeness, and properly collated. It would establish the foundations of a National Public Hygiene in this country, and would be a landmark from which future progress could be estimated. And until some such sanitary survey is accomplished, State Medicine in this country cannot take rank as a science, but must rest mainly upon individual opinion and hypotheses, as it now does.

Whether this Association should undertake the work through its own officers, is the question now presented. It will require much time and labor, and some money, but if successfully performed, the result will be well worth the expenditure.

LIST OF SCHEDULES.

A. *Location, Population, and Climate.*
B. *Topography and Geology.*
C. *Water Supply.*
D. *Drainage and Sewerage.*
E. *Streets and Public Grounds.*
F. *Habitations.*
G. *Gas and Lighting.*
H. *Garbage and Excreta.*
I. *Markets.*
K. *Slaughter Houses and Abattoirs.*
L. *Manufactories and Trades.*
M. *Public School Buildings.*
N. *Hospitals and Public Charities.*
O. *Police and Prisons.*
P. *Fire Establishments, Alarms, Engines, etc.*
Q. *Cemeteries and Burial.*
R. *Public Health Laws and Regulations, Official and Municipal.*
S. *Registration and Statistics of Disease.*
T. *Quarantine.*

The schedules of inquiry comprise between 500 and 600 questions and statements. The following, marked A, B, and N, illustrate the method[1]: —

SCHEDULE *A*.

LOCATION, POPULATION AND CLIMATE.

Name of city, county, and state.
What is its latitude ?
What is its longitude ?

[1] The sixteen other schedules are omitted in this volume, because space is limited.

What is its general altitude above sea level?
What is the altitude above some specific point?
When was the city founded?
When was it incorporated?
Have its boundaries been enlarged?
What was its population in 1860?
What was its population in 1870?
What is its present population?
What is the relative proportion of native and foreign, European, African, Asiatic?
Have meteorological observations been regularly conducted in the city?
If so, by whom and for how long?
Have they been published? If so, where?

The following information is desired in the form of tables, to include a period of twenty years if possible: Mean, maximum, and minimum temperature of each month; direction and velocity of the prevailing winds in each month; amount of rainfall; mean, maximum, and minimum height of barometer for each month (corrected to freezing point, but not to sea level); records of relative and absolute humidity, electricity, ozone; number of clear and cloudy days.

SCHEDULE *B*.

TOPOGRAPHY AND GEOLOGY.

(1) Is the country surrounding your city level, undulating, hilly, mountainous, or low or marshy?

(2) If hilly or mountainous, in what direction and at what distance from your city are the nearest hills or mountains?

(3) How much higher than the general level of your city are the mountains or hills near by?

(4) How many feet lower than the general level of your city are the lowest valleys or ravines near by?

(5) What modifications of meteorological conditions, and what other influences upon health in your city, are apparently due to topographical features of its immediate vicinity?

(6) Is your city surrounded by prairie, forest, market gardens, villages, or ordinary cultivated farms?

(7) Was the site of your city originally level, undulating, or hilly?

(8) To what extent was it traversed by ravines?

(9) How has the surface been materially changed, by grading, etc., from its original outline?

(10) What water-courses have been filled up, formed, changed, or modified?

(11) How many feet above the present ordinary level of your city is the point of greatest elevation?

(12) How many feet below the present ordinary level of your city is the lowest place in it?

(13) Toward what point or points of the compass is the general slope of the surface of your city?

(14) How many feet rise or fall, per mile, in each direction from the centre, or from any given point which you can conveniently name?

(15) In what part of your city, and how many acres of the inhabited portion, is what is known as "made land"?

(16) What streams of water pass through or by your city?

(17) What is the average width of each?

(18) What is the average depth of each?

(19) As regards each stream, is the current rapid, moderate, slow, or sluggish?

(20) To what extent are there natural or artificial falls of water, as over dams, within or near your city?

(21) What canal or race passes through or near an inhabited part of your city?

(22) Is the water in such canal usually clear, turbid, or muddy?

SCHEDULE *N.*

HOSPITALS AND PUBLIC CHARITIES.

(1) What hospitals or alms-houses are located in or near the city?

(2) Have descriptions been published of them? If so, where?

(3) Give for each hospital, infirmary, alms-house, and asylum the following data: location, nature of soil, direction and character of drainage, form, area of grounds, number of stories, number and size of wards, floor room per bed in wards, cubic space per bed, floor plans of building, no matter how rough if dimensions are given carefully.

(4) Heating and ventilation, mode of?

(5) Is it satisfactory? If not, why not?

(6) Water closets, how placed?

(7) How ventilated? Are they satisfactory?

(8) Of what material is the building constructed?

(9) Is it fire proof?

(10) What precautions are taken against fire?

(11) How is the hospital governed, by trustees, municipal board, religious order, or medical men?

(12) How are the governors appointed, by external authority, or by filling their own vacancies?

(13) By whom are the medical staff selected or appointed?

(14) Are there medical officers in the institution, night and day?

(15) What are the titles of the attaches? number of each? how are they appointed?

(16) To what extent do medical men control the management of the hospital?

(17) Who admits and who discharges patients?

(18) Is a record of patients, their diseases and results of treatment kept?

(19) Does the hospital publish or make reports?

(20) What was the original cost of the building?

(21) What is the annual average cost of repairs?

(22) What is the annual average cost of pay of employees?

(23) What is the annual average cost of food?

(24) What is the annual average cost of medicines and apparatus?

(25) What is the annual cost of fuel?

(26) Is the hospital connected with a medical school?

(27) Is there an out-door dispensary connected with it?

(28) What was the number of cases treated during the past year?

(29) Have any cases of hospital zymotic diseases, such as erysipelas, pyæmia, puerperal disease, etc., occurred?

(30) If so, were they confined to one ward?

(31) If not so confined, has any epidemic or endemic influence manifested itself in the neighborhood?

(32) Is the hospital accommodation sufficient for the wants of the city?

(33) Please furnish a copy of the rules and regulations of the hospital.

(34) Is there any dispensary or its equivalent, not connected with a hospital?

(35) If so, furnish rules, regulations, and statistics or reports.

(36) Are there any hospitals specially used for *contagious diseases*, and separated from other general hospitals? or is the *quarantine* hospital of the port used as the "pest hospital" of the city?

(37) What are the facilities for treating poor sick in their own houses, especially as to nurses and special diet?

REMARKS ON MEDICAL TOPOGRAPHY.

BY J. S. BILLINGS, *Assistant Surgeon, U. S. Army.*

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 10, 1875.

IN presenting to the Association the report of the Committee appointed at its last annual meeting to prepare schedules of questions with regard to the medical topography of the principal cities of the United States, it has been thought proper to call attention to the efforts which have been heretofore made to collect data on this subject in the United States, and to the results which have been obtained. The first treatise of this character relating to this country was "An Account of the Weather and Diseases of South Carolina," by Dr. Lionel Chalmers, London, 1776, 2 vols. 8vo, which is even to-day a valuable work of reference. Passing over some scattered papers in the "New York Medical Repository" and the "Medical Museum," the next work of this character was Dr. Drake's "Picture of Cincinnati and the Miami Country," published in Cincinnati in 1813, and again enlarged in 1815. This was the foundation of Dr. Drake's great work on the diseases of the interior valley of North America, — one of the most comprehensive, original, and valuable works of this kind which has ever been produced in any country. In 1843, the Medical Section of the National Institute at Washington prepared and circulated a schedule of inquiries for the purpose of collecting data on this and allied subjects. A few replies were received, which were published in the "Boston Medical and Surgical Journal" in 1844 and 1845.

Upon the formation of the American Medical Association, two delegates, Drs. James Wynne and John M. Thomas, were sent to it by the Institute, and these gentlemen presented a communication from which the following extracts are quoted: "The Medical Department of the National Institute, at a sitting held May, 1845, appointed a committee to inquire into the sanitary condition of the United States, with very extensive powers. The committee issued circulars, soliciting information on the various causes supposed to exercise a prejudicial influence on health. Numerous replies have been received by the committee, but it has, up to the present moment, failed to collect such a minute and, at the same time, extended series of observations as to enable it to make an accurate report, based on such authority as it deemed due to so vital an inquiry. . . . Among others, two prominent causes tended greatly, at the commencement of its labors, to retard its progress — First, the general apathy existing even in the minds of medical men on the subject of Hygiene; and Second, the favorable opinions entertained by almost every one addressed by the committee of the healthfulness of his own locality. . . . .

"The United States may be considered as a country in which no legislative enactments exist regulating its sanitary condition. For, with the exception of some municipal regulations forced from the necessity of circum-

stances upon the large cities, and a few of the first steps of legislation in one or two of the States, each individual is permitted to exercise his own free will in regard to hygienic measures, too frequently at the expense of great sacrifices of human life."

In accordance with the recommendation of the Institute, a Committee on Public Hygiene was appointed by the American Medical Association at its meeting in Baltimore, in May, 1848, of which Dr. Wynne was appointed chairman. This committee proceeded to draw up a schedule of questions, which was a great improvement upon that of the Institute, and which was intended to apply to the principal cities of the United States.[1]

Some interesting papers, which are still valuable for reference, were obtained in this way from the larger cities, and these were duly published in the "Transactions."

Following this example, several of the State Medical Societies undertook to collect Medico-topographical information, usually through the County Medical Societies. A schedule for this purpose was adopted by the State Medical Society of Pennsylvania in 1855, and in the subsequent volume of

[1] The following is the schedule of queries issued by the Committee : —

AMERICAN MEDICAL ASSOCIATION COMMITTEE ON PUBLIC HYGIENE.

It is the purpose of the Committee to make a Sanitary Report, embracing the principal cities in the United States ; and with a view of facilitating their inquiries, you will greatly oblige by furnishing the member of the Committee, who requests the information of you, with answers to the following questions : —

1. What is the population of the town, and its position in relation to the surrounding country ; what the geological formation of the country, the nature of its surface and subsoil, and the means of, or impediments to drainage, more especially within the town limits ?

2. What is the character of the town in reference to health ? What is the condition of its most unhealthy and crowded parts ; where disease is supposed to be most prevalent ; and to what causes are such diseases mainly attributable ?

3. What are the arrangements for drainage ? Is there a public survey of levels ? Are the streets and alleys paved, and laid out with a proper inclination for surface drainage, and is the mode adopted effective ?

4. What is the mode and expense of cleansing the streets ? Are the courts and alleys occupied by the poor cleaned, and how often ? Where is the refuse from the houses deposited, and where is the street manure kept, and how disposed of ?

5. What is the condition of the more densely populated parts of the town in respect to ventilation ? Are the streets wide or narrow ? Are courts and alleys built up, and closed at the end, and what is the character of the houses of the poor ? What number of families occupy one house ; how many persons live in one room, and what provision for ventilation ? How are the houses warmed in winter ?

6. What is the system of public schools, and its influence on health ? At what ages are children received into them ? What is the size of the room, the number of occupants, time allotted to instruction, means afforded for exercise in the open air, and length of summer vacation ?

7. What hospitals and dispensaries ? How are the public buildings ventilated, as churches, etc., and what provision for public grounds or squares ?

8. From what source is the town supplied with water ? What are its qualities, and is it abundant ?

9. Are the municipal regulations on the above subjects effective or not ?

its transactions will be found reports from some of the counties, prepared in accordance with this list.[1]

[1] Form of county reports to the Medical Society of the State of Pennsylvania :[1] —

I. Causes which modify the health of the county : —

1. Locality : —

Boundaries of county, and its situation in the State.

Its proximity to large rivers and the lakes ; to mountain ranges ; their direction and extent.

2. Hydrography or drainage : —

Size and direction of water-courses, and of the dividing ridges or water-sheds.

Extent of river bottom.

Power and rapidity of streams ; danger and frequency of inundation.

Quantity of marshy or springy soil.

Artificial water channels and reservoirs ; amount of lockage.

3. Topography : —

Area and mean altitude of county.

Population, and their lineage ; chief avocations.

Location and size of principal towns.

General character of surface ; principal valleys and eminences.

Nature and extent of surface — destitute of vegetation, tilled, covered with forest, or in grass.

Agricultural produce ; kinds of timber ; effects of clearing and of drainage on climate ; extent of artificial irrigation.

4. Geology : —

Geological position, actual location, dip, direction and extent of the different formations.

Character of soil, subsoil, and subjacent rock.

Source and nature of water used for domestic purposes.

Supply of water to towns ; kind of pipes used as conduits.

Map with geological features named, and colored agreeably to the order adopted by the State Geologist.[2]

5. Meteorology :[3] —

Latitude, longitude, and altitude of observer.

Barometric, thermometric, and hygrometric states of the atmosphere for every day in the year, indicating in columns the amount in inches of rain, hail, and snow.

II. Mortuary Tables :[4] —

1. Mortality : —

From fevers ; from measles, small-pox, and varioloid.

From diseases of the lungs and air passages.

From diseases of the nervous system.

From diseases of the organs of nutrition.

From diseases of the urino-genital organs.

2. Causes assigned for death where the number exceeds ten per cent. of the whole.

3. Quarterly Tables, showing the whole number of deaths of white and of colored persons under one year, from one to two, from two to five, from five to ten, from ten to fifteen, from fifteen to twenty, and for every decimal period over twenty.

III. Prevalent Diseases.[5]

1. Epidemics and endemics for the year : —

[1] See printed *Transactions*, vol. v., p. 52.

[2] Inclose by dotted lines with proper marginal references, those sections of the county in which epidemics have prevailed.

[3] Observers for the Franklin Institute, Philadelphia, as well as for the Smithsonian Institution, Washington, reside in a number of the counties, and would furnish all the meteorological information required. See p. 16, Part III., 1858.

[4] If, as is to be feared in many counties, the materials for this classification cannot be obtained, the reporter is requested to approximate as closely to it as his means of information will admit.

[5] In describing cases, give the age, sex, condition, and location of patient, season of year, treatment, and termination.

The transactions of other State Medical Societies, and more especially of New York, New Jersey, Ohio, Kentucky, Indiana, Tennessee, and Alabama, also contain some county and municipal reports upon a somewhat similar plan. It needs, however, but a brief examination of these records to prove that a comprehensive sanitary survey of a State will probably never be accomplished by a State Medical Society, unless, indeed, it should by the present State Medical Society of Alabama, under its peculiar powers as a State Board of Health. The scattered papers, above referred to, lose much of their value for the want of proper revision, collation, and comparison; and, indeed, the published transactions of nearly all medical societies and associations in this country need editing more than almost anything else. In all branches of science in which the Baconian system of investigation is to be pursued with advantage, the work must be divided between collectors and collators. All men have the power and the opportunity to collect data; but comparatively few are in such positions as to have access to the materials which are gathered in museums, libraries, etc.; and of these few but a small percentage have the inclination or ability to collect, compare, and systematize the scattered observations of the collectors.

The most valuable contributions to medical topography in this country, so far as regards completeness, and as affording data for a science of the etiology of disease, are the reports made by medical officers of the army, descriptive of their several posts, of which four volumes have been published. This is due to the fact that these reports give the statistics of disease and the meteorology of each post upon a uniform plan, and thus afford the means of comparison between different localities. It is evident that the foundation of medical topography, as it should be, must rest upon statistics of disease. We desire that it shall give us the following information: —

1*st.* What is the healthfulness of a given place?

2*d.* What diseases will probably be aggravated, and what will probably be relieved, by a residence in that place?

3*d.* What are the causes, local or epidemic and climatic, of disease?

4*th.* What attempts are being made to improve the topography of the place with reference to its sanitary condition?

It has been an article of professional as well as popular belief, since the days of Hippocrates, that the study of prevailing diseases of different places,

Their origin and march; apparently contagious or not; how affected by race, age, sex, temperament, avocation, circumfusa, ingesta, and the density of population.

2. Fevers: —

Intermittent and remittent; their frequency as compared with that of former years.

Typhus and typhoid fevers; small-pox; benefits of vaccination; measles; scarlatina.

3. Other Diseases: —

(1.) Observations on their etiology, pathology, and therapeutics.

(2.) Peculiarity of type or tendency.

(3.) Number of cases, and a comparison of it with that of other years.

4. Miscellaneous: —

(1.) Medical effects of indigenous plants, and of new remedies.

(2.) Facts of interest in surgery and obstetrics.

(3.) Notices of members deceased during the year.

with reference to their local causes, is of great value, and that all work in this direction should be encouraged as much as possible.

Many books and essays have been printed under the title of Medical Topography; and, to judge from the bibliography of the subject only, we might fairly suppose that a large amount of data — scattered and disconnected it is true — has been obtained and recorded. But when we come to examine these papers in detail, it will be found in most cases that while topographical data are given, the medical part has been left out; that the majority of them refer to but one form of disease, — the malarial, — and to the conditions which affect its prevalence, and that the information in regard to this is vague and general. Even the most complete and satisfactory essays, with the exception of the Army Reports, rely upon mortality statistics alone; and these, no matter how complete, will not furnish the information necessary for a satisfactory investigation into the causes of disease, which is the one great object of medical topography.

We want to know how many of a given population have been sick; of what disease, and for how long. For this purpose the statistics of all diseases are not of equal importance; for we can expect no special advantage from knowing how many cases of venereal or delirium tremens occur in a given square; but we must, of course, record many facts, for the same reason that the pearl-diver collects many oysters, — because we do not know whether they are valuable or not. For instance, most persons would say that topography has no relation to cancer, and yet there are some curious coincidences with regard to its prevalence in limited localities. Whether it is possible to obtain for a city or district, statistics of the prevailing diseases sufficiently complete to admit of scientific reasoning with regard to their causes, is a question of much interest and importance. The practical difficulties in the way of obtaining such statistics are very great; but they are not to be done away with by ignoring or under-estimating them. These statistics can, of course, be obtained only by the aid of physicians; but to induce physicians to undertake such a task as this, some sufficient motive must be presented.

It must be remembered that the art, or the so-called practical part of public hygiene, does not specially pertain to the medical profession. Medical men have been foremost in urging attention to the prevention of disease, both on the part of individuals and the public; not because it is specially to their interest to do so, but because their sympathies are daily and hourly appealed to by the spectacle of human suffering which they know might have been prevented, but which they find difficult or impossible to relieve.

Medical men see more or less distinctly, that a properly organized system of State medicine, or public hygiene, would require from each of them a certain — and from many a considerable — amount of labor, in keeping records and furnishing information, while no corresponding recompense is proposed. They are naturally unwilling to furnish information to, and coöperate with persons in whose selection for the position of health officer they have had no voice, and for whom they often have little respect; and this will continue so long as the medical profession is not consulted in the selection of State and municipal sanitary authorities. To undertake to ascertain for a large

city the number of cases, and the results of each form of disease, is practically impossible. It is hard enough to obtain the statistics of causes of death with any reasonable degree of accuracy, since physicians, like other people, are not addicted to doing steady work without some compensation; but if, instead of all diseases, we devote our attention to a few, the prospect is not so hopeless.

With regard to certain epidemic diseases, such as cholera, and cerebro-spinal fever, records have been obtained in the largest city in this country, with sufficient completeness to furnish valuable results.

It is true that in the presence of an epidemic, people will do, and permit to be done, much that at other times would be impossible, and cholera has in this way indirectly effected so much for public hygiene, that in the long run it may have saved more lives than it has destroyed. But as people are made to understand that the common diseases, always present and little thought of, are the causes of more loss of money, labor, and life, than the pestilence in whose presence no amount of expenditure and exertion has seemed too great, it may yet be possible to obtain authority and means to obtain the information whereby their progress may be estimated and combated.

By the comparison and study of the daily bulletin maps of the Signal Bureau, we have learned somewhat of the paths, rate of travel, and phenomena of the air-whirlpools, and it is not impossible that we may yet, in like manner and by somewhat similar means, become acquainted with the course of certain diseases, and, if not able to prevent, can at least warn and avoid.

Suppose a local medical society, county or municipal, undertakes to collect the medical statistics of its locality; how is it to set to work?

The first suggestion would be that each member should keep a record of the cases of disease which he observes, and of the locality in which they occur.

To attempt this with any prospect of success, it is necessary to agree upon a list of diseases to be recorded, and to select for this list such forms of disease as are easy of diagnosis, and of which the nomenclature is uniformly agreed on.

It is furthermore absolutely essential that each physician shall make his report daily to the secretary, upon a small convenient blank form, to be placed in a stamped and directed envelope provided for the purpose. If the necessary medical statistics can be obtained, the remainder of the data for a medical topography can certainly be gathered. Some of the most interesting points to be noted are those which seem to be exceptions to the general rules. We want to know the particulars of localities where the presence of marshes or stagnant water does not seem to produce malaria; where impure and contaminated water supply has not produced disease; and where defective traps and escape of sewer gas in houses has produced no ill effects.

A satisfactory medical topography should have reference not only to the causation but to the prevention and cure of disease. Change of locality, as a therapeutic agent, is coming more and more into use, especially as regards

diseases of the lungs, rheumatism, etc.; but as yet, physicians have no sufficient data to guide them in recommending given localities to their patients.

In Europe, great use is made of health reports, baths, and mineral waters, and considerable progress has been made in determining their effects in different diseases. For the United States, most of this work is to be done, except as regards meteorological observations. Finally, it must be remembered that the medical topography of a place is not the same at different seasons, or in successive years, and that a continuous series of observations will be necessary to develop the full value of this mode of investigation.

We must endeavor to ascertain what the French call "the medical constitution of a place"; the results of epidemic influences which are not yet epidemics, and the modifications which these undergo in different localities.

It may be thought that the field thus indicated is discouragingly wide, and the prospect of practical results so remote that we may as well attempt nothing. But if the astronomer will begin and carry out a series of observations of the movements of a star, which will require the labor of centuries before trustworthy deductions can be drawn, is it so hopeless that the operations of the microcosm will yet be studied with similar minuteness and patience? more especially as in this — more than in any branch of science the aphorism holds good that "Knowledge is power."

In medical topography as a science, there has been little advance for a thousand years, and so long as the present methods are pursued, no great additions to our knowledge in this direction can be expected. Vague generalities and opinions must be replaced by specific information, and from square miles we must come down to square feet. The results which we now have, can best be compared to those obtained by the young chemist who made an analysis of a rat — putting the entire animal into his crucible. The importance to a State or government of a complete topographical survey of its possessions has long been recognized; and much as has been done in this direction, it is now urged, by those most familiar with the subject, that in all of the States of this country a careful survey, with the preparation of maps on a large scale, similar to the work which has been done in England and Switzerland, is necessary, and must sooner or later be effected. And it can hardly be doubted that in such surveys the prevailing diseases of each locality should be recorded as carefully as its geology, botany, or zoölogy.

To obtain the statistics of disease, or even of mortality, which are necessary to make a truly valuable medical topography, must be a work of the future, since these data do not now exist, and cannot be obtained by any system of inquiry; and it is respectfully submitted whether the time has not arrived to secure such action on the part of National, State, County, and Municipal Medical Associations, as to insure at least an attempt to collect these extremely desirable statistics, and whether this Association, both as a body and through the voice of its individual members, should not urge the commencement, at least, of this undertaking. As this labor must be performed by physicians, the question arises, what inducements can be offered them to undertake such labor, which, to produce valuable results, must extend over a series of years. From voluntary effort on the part of physicians, only

a commencement can be hoped for, but this may be sufficient to prove to our legislators and to the people the value and the necessity of such work. And if this be accomplished, it cannot be doubted that physicians will be recognized as servants of the government, and that the necessary steps will be taken to insure proper qualifications on their part, and to distinguish in some way the educated and scientific physician from the ignorant pretender; and this would be considered sufficient compensation by the great majority of the medical profession.

PRELIMINARY REPORT ON THE SANITARY CONDITIONS OF AMERICAN WATERING PLACES.

By HENRY HARTSHORNE, M. D.

READ AT THE ANNUAL MEETING, BALTIMORE, NOVEMBER 9, 1875.

Upon the subject of those natural local advantages for which multitudes resort to our great watering places, namely, original salubrity of atmosphere, medicinal waters, change of mental and bodily impressions, and wholesome enjoyment of the beauty of varied scenery, — the common stock of knowledge, and special treatises of climatologists and authors upon mineral springs, may suffice. It is the intention of this paper to point out particularly what further knowledge is important yet to be obtained in order not only to estimate rightly the actual usefulness of these resorts, but to afford measures for the entire realization of their benefits by the prevention or removal of existing drawbacks thereto; that is, of *incidental unsanitary conditions.*

These drawbacks are apt to be connected especially with the occurrence of times of great periodical increase of population, at places where everything is *temporary*, as it were, and migratory, not permanent. A watering place is a kind of *developed camp*. The same principles of sanitary science and practice, essentially, are capable of illustration in camps and in places of summer resort.

One general fact is fundamental here: that there is in nature, apart from human invasion or interference, a *balance* of formation and destruction, of life and death, food and waste; making a perfect natural *economy* everywhere. Primeval forests are *clean*, though abounding in luxuriant life, every one of whose forms runs rapidly into decay; as every particle, as soon as it dies, is taken up by some of those myriad organisms, vegetable or animal, minute or large, which are everywhere seeking for food in the great struggle for existence. Man comes in with his artificial constructions, and sweeps away much of this balanced economy of nature. Under his tread the green earth grows bare. His habitations, transient or permanent, exclude multitudes of the lower and lesser denizens of the same region, whose natural functions as scavengers, or, as it were, heaven-appointed sanitary officers, are thus impaired or annulled.

Hence comes "matter out of place;" foulness of the earth, water, and air; stench, miasma, pestilence. Nature seems to wage incessant guerrilla warfare, a strife to the death, with her invader. Yet, man's conquest over Nature is legitimate. What is wanting? Simply, that our reason should be used in counting the true cost of civilization, and meeting all its conditions as they exist, wisely. We must maintain or restore the original balance of primeval nature, by providing for the re-appropriation of the products of life and the results of death and decav around us.

In applying this large general principle, the evils to be guarded against in the camp, the new settlement, or the temporary watering place. are found belonging chiefly to the deterioriation of drinking-water and atmosphere, under the influence of excretory matter. Every human being gives out constantly, from his lungs, skin, and otherwise, about as much as is from day to day received by him as food, drink, and air of respiration. We take inorganic atmosphere and water, and disorganized, though recently living, grains, fruits, roots, and flesh, etc., into our systems; we organize or consume them, and then throw them out again to be rapidly decomposed. The higher the life they have attained in us, the deadlier poisons they become in their *effete* molecular death. Thus *crowd-poison* breeds typhus and typhoid fever, and promotes diphtheria, cholera infantum, and malignant cholera; nay, gives special aid and sustenance to all *zymotic* disease-causes, — such as small-pox, scarlet fever, and the rest, and contributes greatly to the mortality from phthisis, pneumonia, and nervous affections, especially those attended by convulsions in children.

In watering places, as already said, the sanitary requirements least apt to be early and fully considered are those concerning drainage and *conservancy*, — *i. e.*, prompt and perfect disposal of human and animal excreta, and the removal of offal of all kinds, — and providing and preserving in purity good drinking-water. Local advantages, with the usual appropriation of large or considerable spaces for the accommodation of those who seek health resorts, and the absence of most of the population from those localities through a number of months of the year, have prevented such deficiencies from very frequently making themselves known by serious disease and mortality. Yet marked epidemics, or rather endemics, have repeatedly occurred, as warnings that should be heeded; and scattered cases of sickness thus produced, sometimes fatal, have no doubt been more numerous.

Mount Desert and Lake Mahopac are especially well known to have, within a few seasons, had their times of special reversal of that relation to health for which they have been visited from year to year. Newport suffered with cholera in 1854; Atlantic City, a few years ago, had a number of cases of typhoid fever; and Saratoga has had, during the present year, a greater mortality from diarrhœal disorders than rightly belongs to its population.

Now, what is to be done, to anticipate or remove, to make impossible, such unsanitary conditions? First, for a practical illustration, let us see what is the *worst* possible method to be pursued.

We will suppose a place upon the sea-shore to be selected for a new summer resort. One or two hotels are erected, half a dozen boarding-houses are built, and from fifty to a hundred cottages; the latter, say, upon lots about fifty by one hundred feet each. Each hotel, boarding-house, and cottage must have its supply of water for drinking, cooking, and washing; its kitchen drain, and its privy. Convenience suggests, and the limits of each property dictate, that each of these, or at least the first and last, shall be *as near the house as possible*, and therefore *very close to each other*. Within eight or ten feet of the kitchen door, a driven well, fifteen or twenty feet deep, may bring up a supply of water for domestic purposes. Ten or fifteen

feet farther off, a well is dug for necessary use; and, perhaps, another, or the same, receives the termination of the kitchen drain. In other words, *two or three holes are bored or dug in the sand*, into one or two of which a deposit of semi-liquid filth is made, while from the other one water is drawn up to drink! Hardly is this in any respect an imaginary or overdrawn picture. Summer before last, I visited a place almost precisely thus misprovided. Every one there, younger and older, had to go through a seasoning diarrhœa; children, at least, doing so at the risk of their lives. The wonder only was, that so many survived and recovered, showing how fair a filter, for a while, sand is, and what endurance, in a good natural atmosphere, the human system possesses. Season by season, unless improved in its conditions and management, such a place must become more unhealthy, until some marked mortality compels either its desertion or its renovation.

As thus presented, I think we may see what are the problems in view. The chief one is, *to obtain drinking water untainted by excrement or house drainage.* Shall we *avoid* the ground as a source of water supply, or shall we endeavor to *protect* the ground from contamination?

The first is a simple measure, when arrangements are made for collecting *rain-water.* This may be done by placing a reservoir on the top of the house, or by draining the rain-fall from a slate roof. In either case, it should pass through a gravel, or better, a charcoal and gravel filter before being used. In the city of Dubuque, Iowa, whole blocks of houses are thus constantly provided with a pleasant and wholesome water. Several other towns in different parts of this country are, I understand, so also. At Atlantic City, two years ago, as I have been informed by a gentleman familiar with that resort, among quite a number of cottages in which typhoid fever occurred, all were supplied with water from driven wells; while every family drinking *rain-water only*, escaped the disease.

Another method, of course more expensive, will be to have good water brought from a distance in pipes or by aqueducts.

On the other hand, the non-contamination of the ground may be sought for, by the use of sealed, non-porous privy-wells. This is the method which was resorted to, last summer, at Ocean Grove, New Jersey, under the controlling management of the Association which owns the settlement, and whose rules define the conditions of sale to all purchasers of lots for dwelling-houses. Every house was required to have in use the following arrangement:

A box was made of two-inch planks, saturated without and within with coal tar; for a private family, this box may be three feet long, the same in depth, and two feet in width. Outside of this is an impermeable layer, nine inches thick, composed of two thirds Roman cement and one third mortar; and outside of that a firm setting of brick. The brick and cement make a permanent trough, in which the tarred box is placed, to be removed *twice at least* every season, under the direction of the officers of the Company. The introduction of this method of conservancy, as I am told by W. C. Bakes, pharmacist, who has an establishment at Ocean Grove, has been attended by a marked improvement in the health of the locality, especially as regards diarrhœal affections.

Driven wells are in general use there, and are now uncontaminated, unless it may be by kitchen drainage, or by underground communication with a fresh-water lake receiving such drainage in the vicinity.

Obviously, to secure the universal use of sealed wells of deposit in every place, and thus to protect the ground from fecal contamination and saturation, there must be some one *controlling authority*. This is not often present at our watering places.

Moreover, *kitchen drainage* is not, on this plan, excluded from the ground. By means of pipes, it may be, and commonly is, conducted to a sunken barrel or shallow well at the rear end of each lot. This *minimizes* the evil. During a short summer season, the natural sand-filtration may accomplish the most of what is needed for protection. Yet such protection is still of doubtful sufficiency. Investigations in the north of England have shown (as testified to by George Waring, Jr., on *Sanitary Drainage*, "Atlantic Monthly," November, 1875, page 537) that the ordinary contents of public sewers receiving only kitchen wastes, house-slops, and the washings of the streets, without any water-closet connection at all, are apparently as foul and offensive as when they receive all the ordure of the town.

Further: the cemented privies *detain* everything, and thus require special arrangements to prevent their tainting the *air* around them. Foul water-closets do perceptibly spoil the atmosphere in some grand hotels, in unquestionably salubrious localities. At one mountain resort, magnificent in natural situation, which I visited this last summer, the unsanitary odor was recognizable before entering the house, at a distance of a hundred yards, and became too intense to be forgotten, within and through nearly half the building.

How is this to be prevented? Better than disinfectants (which, however, may be often useful) will be *downward water-closet ventilation*. The principle of this is not new, having been in use in a celebrated dissecting room in Paris for many years. Lewis Leeds, sanitary engineer, introduced it with excellent effect in a number of United States General Hospitals, during the late war in this country. Practically, as applicable to watering places, hotels, and boarding-houses, William G. Rhoads, of Philadelphia, has recently obtained ample demonstration of its serviceableness at Atlantic City, New Jersey. The plan is simple. It requires only that the outlet pipe from each water-closet should have an efficient water *trap*, and that, just above the trap, a vent pipe should pass off so as to enter the kitchen chimney. The upward draught of this, the fire being always kept burning, will insure a downward draught *into* (instead of out of) the water-closet. Of course the trap is an essential part of this arrangement. Not only at places of public resort, but in the smallest as well as the largest private dwellings, the same principle may be carried out with great advantage.

In reference to the whole subject of this paper, more definite and numerous *facts* are wanting, such as will compel public and private attention to what are certainly to be regarded as at least imperfect sanitary conditions at many watering places. We need sanitary and mortuary *statistics* of these resorts. Dr. Farr has commenced the work in regard to them in England, having

already tabulated the diseases and mortuary records of forty-eight English watering places, for the spring quarter of 1875, so far as refers to the total death-rate, and to that from five zymotic diseases: small-pox, scarlet fever, measles, diphtheria, and whooping-cough. He has found great diversity in the average death-rate among these forty-eight towns; ranging all the way from 12.6 deaths per 1000 of population to 28 deaths per 1000, during that part of the year in which the migrating or visiting portion of their population is absent. Also, the *zymotic* mortality differs much: *e. g.*, from .5 of 1 per 1000 annually, at Cheltenham, to 3.5 per 1000 at Folkstone and Whitby. Such statistics need to have added to them full particulars concerning disease and mortality *during the season* when visitors throng the watering places; and, with these, facts concerning their local conditions and sanitary provisions and regulations, which will show the relation of cause and effect between favorable and unfavorable arrangements and their results.

In order to obtain this information in our country, I desire to suggest that it be requested of physicians and sanitary inquirers residing at or visiting watering places, to procure facts bearing upon their vital statistics and sanitary conditions, and to transmit them, during the coming year, to the Secretary of the American Public Health Association, at New York. The large experience and ability of this officer, so well known in similar useful labors, will insure such employment of the materials thus furnished as must redound to great public advantage.

I conclude with the following propositions, in summary: —

First. A real danger exists to health, at all watering places, or other places of temporary public resort, in connection with the possible contamination of drinking water (as well as of the atmosphere) by soil-saturation with ordure and house drainage.

Second. To prevent this, one or both of two measures must be resorted to: (*a*), to use, for drinking and cooking, either rain water or water conveyed from a distant uncontaminated source; (*b*), to protect the soil from contamination by impervious wells of deposit for all matters of impurity.

Third. The former of these measures may be always unhesitatingly recommended. For the latter to be availingly carried out, requires the existence of a controlling authority, to provide apparatus in the first place, and to secure afterwards sufficiently frequent removals and purifications.

Fourth. Sealed depositories of filth must be more liable than others to yield insalubrious emanations to the atmosphere. Besides, therefore, the use of sulphate of iron or chloride of lime for disinfection, such emanations may be removed and dissipated most effectually by *downward ventilation* of trapped water-closets, by means of vent pipes *communicating with kitchen chimneys*.

Lastly, it is very desirable that records of disease and mortuary statistics, and exact accounts of all the sanitary conditions, of the watering places of the United States, should be procured and collected for analysis and comparison at some central point. For their collection, examination, and utilization, no person would be more competent and suitable than the Secretary of the American Public Health Association.

THE GATHERING, PACKING, TRANSPORTATION, AND SALE OF FRESH VEGETABLES AND FRUITS; THEIR CHEMICAL CONSTITUTION AND NUTRITIVE VALUE; COMPETENT INSPECTION AND FREE MARKETS FOR PRODUCERS.

By SAMUEL C. BUSEY, M. D., *Washington, D. C.*

READ AT THE ANNUAL MEETING, PHILADELPHIA, NOVEMBER 11, 1874.

It is not my purpose, at present, to discuss this question in all its important relations to the health of cities and of communities of consumers, but briefly to invite the attention of this Association to a few suggestive inquiries, with the view of securing, through a competent committee, a thorough consideration of the effects upon public health of the deterioration of fresh vegetables and fruits, as offered for sale in the markets of the principal cities of this country, and how far this deterioration is attributable to the manner of gathering, mode of packing, and transportation from the farm or garden to the city markets.

No one will maintain that masses of consumers can be supplied with vegetables and fruits in the same state of freshness and perfection as the rural population, for all must admit that under the most favorable conditions, with every requisite care, many vegetables and fruits rapidly lose freshness, flavor, and nutrient qualities. The state of perfect maturity speedily passes, and deterioration and decay begin. So, likewise, must it be conceded that, as a rule, fresh and mature vegetables, in their proper seasons, contribute to enjoyment and health, and in the country rarely provoke disease; and, furthermore, I need hardly remind you that, in our American cities, the summer intestinal diseases and digestive troubles usually begin with the introduction of certain fresh vegetables. Here I shall be met with the objection that the intestinal diseases mostly prevail among very young children, who are consumers of vegetables and fruits to a very limited extent, and that the rising temperature, so necessary to the growth and maturity of vegetables, together with the foul exhalations and improper hygienic conditions, contribute chiefly to the production of the wide-spread epidemics of intestinal diseases which annually decimate the infantile population. The influence of these agencies I concede, but I am impressed with the conviction that intestinal diseases as frequently find their cause in that which is ingested as in that which is smelled or inhaled. The cause is often something more tangible and gustatory than the fœtid and subtle emanations which hygienists have striven so long to define and to circumscribe. I am disposed to shield Providence from the alleged agency in the causation of many of the "ills which flesh is heir to," and to ascribe them to the indulgence of our own insatiate thirst and fondness for the "good things of this world." Even among very young children, the intestinal diseases are frequently directly traceable to the ingestion of unwholesome fruits and vegetables; nor is the nursling

exempt from the danger, even though the deleterious influence may only reach it through the defective milk supply of the mother feeding upon immature or deteriorated vegetables and fruits.[1] In this connection I will briefly invite attention to a few admitted facts. Not that I wish to use them to maintain any exclusive doctrine of causation, or to construct any new theory, but rather to extend the field of inquiry, and to direct your studies away from a too exclusive consideration of the very prevalently received opinions and theories in regard to the ever fermenting and wide spreading agency of bad smelling, impure, and foul exhalations, as the chief and segregate cause of summer intestinal diseases.

Intestinal diseases, both among adults and children, are comparatively rare in the farming regions, and both classes of the rural population, adult and infantile, are more generally consumers of fruits and vegetables, and suffer less detriment therefrom, than like classes of the population of cities. Far the larger proportion of infantile intestinal diseases occurs among those beyond the age of six months, that is, subsequent to the period at which the natural aliment is usually considered by the laity adequate to the demands of growth and development; and far the larger percentage of mortality occurs among the children of the poor and squalid residents of cities, — the class necessarily the most indiscreet consumers of cheap and deteriorated vegetables and fruits. Statistics establish the greater prevalence of these diseases

[1] The influence of lactation, both natural and artificial, in the causation of infantile intestinal diseases, is far too frequently overlooked. Milk is the natural aliment of young animals, but the nursling is very frequently fed exclusively upon milk wholly deficient in the necessary nutrient and healthy constituents, and, indeed, often upon it when it is diseased. The unwholesome and sometimes pernicious changes produced in the mother's milk by sudden bursts of passion, by a nervous temperament, by menstruation and pregnancy, by excessive sexual indulgence, by irregular habits of life, and by certain articles of diet, are too well established by clinical observation, if not by chemical analysis, to be considered as mere coincidences unworthy of the attention and careful scrutiny of the scientific physician. Decaisne (*London Lancet*, Sept. 1872) has shown that insufficient food may occasion very serious and varied disturbances of the quality of the milk. In his report to the Academie des Sciences of the results of his observations of forty-three women who nursed their infants during the siege of Paris, he deduced the conclusions that some women may, upon insufficient diet, produce abundant and rich milk, and their children will thrive, while they themselves will emaciate. Another class will produce but little milk, and that very poor, and their children will suffer for want of nutriment, and sicken with choleraic diarrhœa, and a third class will produce scarcely any, and their children will die. In syphilitic mothers the proportion of sugar is diminished and water increased in the milk; fever lessens, and may suppress the secretion; emotion, mental anxiety, and sorrow may diminish it or render it poisonous; puerperal fever seriously disturbs its healthy qualities; insufficient air, sedentary habits, and want of cleanliness not unfrequently impart to it conditions injurious to the health of the nursling. Certain drugs administered to the mother may affect the infant. Iodine can be detected in the milk; mercury given to syphilitic mothers will be conveyed to the suckling; opiates and some purgatives will demonstrate their physiological effects upon the infant. Lettuce imparts its qualities to the milk, yielding "when inspissated, (Redwood) lettuce opium, or lactucarium." Garlic, the onion, cabbage, turnips, and even green clover will impart a distinctive aroma to the milk of cows feeding upon them. But more important are the facts that the quality and quantity of the milk are dependent upon the character of the food and the vigor and healthfulness of the digestion. A meagre diet affects almost exclusively the quantity of butter and casein; a bad diet imparts deleterious qualities.

between the ages of six and thirty months, and among the artificially fed, and greater proportionate mortality in the densely populated districts, and among the children of the poorer classes. Can it be that those under six months, those advanced beyond thirty months, and those nursed at the breast, are less exposed to and less impressible by atmospheric influences? Undoubtedly the intercurrent affections and developmental peculiarities of the period exercise very considerable influence in predisposing to intestinal disease; but, assuredly, improper alimentation must constitute the chief among the many factors concerned in the etiology.[1] It is then manifest that intestinal diseases are most prevalent during the warmer months of the year — June, July, August, and September, when vegetables and fruits are most abundant and deterioration most rapid,— are proportionately far more frequent among communities of consumers who can only obtain supplies by purchase, and are most fatal among the poor, who from necessity become the purchasers of the cheapest and most deteriorated.

These are significant facts, not adduced to disprove the manifold ill effects of a bad atmosphere, and of fœtid exhalations, but to invite your attention to the consideration of another, and perhaps as frequent and direct an agnecy in the causation of intestinal diseases; and to illustrate, as well, the comparative innocuousness of fresh, mature, and properly gathered fruits and vegetables, as to demonstrate their pernicious and disease-producing qualities as supplied to and consumed by the inhabitants of cities.

To further elaborate the distinct question here at issue — the agency of immature and deteriorated fruits and vegetables in producing intestinal diseases, and the more strikingly to exhibit the qualitative changes which they speedily undergo after preparation for market — I will select a few of those most generally consumed, and describe the mode of gathering, packing, and conveying, and their condition when exposed for sale.

The Irish potato, *Solanum tuberosum*, perhaps the most popular aliment supplied from the "truck farm," when mature and properly cooked, is a wholesome and nutritious article of diet, carries well, and preserves its flavor and nutrient qualities, even in very warm weather, for a reasonable time. It has a stage of ripeness, marked by a thick and firmly adherent skin, and when cooked breaks, upon very gentle pressure, into a semi-dry mealy mass. In this condition the producer supplies them to his own family. Young children consume them with comparative impunity. In the early spring, we are usually supplied from Bermuda with a variety which, as a rule, is in a fair state of preservation, but the general demand and high price soon draw a supply in succession from Savannah, Charleston, Norfolk, and the

[1] Starchy aliments are indigestible in consequence of the feebleness of the digestive properties of the salivary, pancreatic, and intestinal juices of young children. They are also deficient in "materials for the re-integration of the principal tissues, which is so necessary to the growing infant." Sonsino established the condition of "physiological dyspepsia in infants for starchy aliments." Korowin has deduced the conclusion from a series of experiments that the property of the pancreatic juice to transform starch into sugar is only manifest after the third month of life, but that the parotidean saliva possesses this power from birth. In regard to both secretions, this power becomes more active with the development of the child.

farms in the immediate vicinity. The tubers are gathered, not because they are ripe, but because they are merchantable, that is, have attained sufficient size, perhaps washed, better not, packed in barrels and transported to the place of sale. In this tender, succulent, and growing state they are easily bruised, have a smooth, thin, delicate, and slightly adherent surface covering, and we find them in the market with partially peeled and ragged surfaces, the loosened parts of the cuticle partially attached to the remaining adhering pieces. These are the unavoidable results of gathering before maturity, rough handling, improper packing, and of the heating process — preliminary to other deteriorating changes, through which they wholly or partially pass before they are exposed for sale. The extent of these degenerative changes is proportionate to the lapse of time and closeness of packing, and perhaps also to the mode of transportation. The heating, or rather steaming, process favors the detachment of the partially developed cuticle, as it does of the matured skin. I need hardly inform you that the destruction or removal of the surface covering which nature provides for protection and preservation, favors and hastens the decay of all perishable fruits and vegetables. Such tubers cook waxy, cut cheese-like, bite doughy, and taste greenish and weedy. They are served upon our tables with savory dressings, and eaten with relish, but they are only partially digestible, and, in the main, pass from the bowels in white, doughy, unaffected lumps. Of the consumers, some escape unhurt, some suffer a pang or two, others, fortunately, purge freely, but the less fortunate suffer more seriously. To many young children, whose digestive powers are inadequate to the complete digestion of any starchy aliment, these tubers, mashed and commingled with savory gravies, are fed as choice and nutrient morsels, and when sickness and suffering come, the temperature — not above 70° at mid-day — or some distant slaughter-house or bone-boiling establishment is charged with the dire calamity. The potato probably ripens from exterior to centre; hence, after cooking, it may frequently be observed that immediately under the apparently ripened skin, a layer of greater or less thickness, according as the stage of ripeness has advanced, of a semi-dry, farinaceous mass, will scale from a firm and waxy central portion, so that one may be deceived by the manifest external evidences of ripeness. The potato deteriorates by growing out or germinating. If left in the ground long after maturity, during a growing season, from one or more of the buds or eyes will grow appendages resembling in every respect the mother tuber — they are, in fact, homologous outgrowths. The presence of such a tumor is the evidence of a second growth, and if broken off, as is usually the case when offered for sale, the surface is denuded at the point of attachment. When improperly stored, and especially during the later spring months, the tubers germinate, and from each eye, rootlets shoot forth, which are likewise broken off before being exposed for sale, but the surface exhibits no denudation, and the condition can only be detected by a very careful inspection of the buds, and, perhaps, a softer feel. The density may have diminished because of the commencement of germination. Freezing destroys the organization of the potato, and with thawing the putrefactive changes begin. Notwithstanding, it is a very common occurrence for dealers to offer, and for

consumers to purchase frozen potatoes. "The potato," says Pavy, "is made up of cells, penetrated and surrounded by a watery albuminous juice, and filled with a number of starch granules." Cooking coagulates the albumen, and the starch granules absorb the watery part; hence the cells are distended, and their cohesion being destroyed, the potato breaks down into a "loose farinaceous mass." "Young potatoes" (Chambers' "Manual of Diet," p. 43,) "from not so easily breaking up, require long mastication to render them soluble, and are not then very digestible. But old waxy potatoes are worse, for they seem to unite again into a sticky mass, after being swallowed, and remain for hours undissolved." The worst of all are potatoes affected with disease.

The potato contains[1] per ounce (437.5 grains), in its natural state, 324 grains of water, 1 of nitrogen, 49 of carbon, and 4.4 of salts. These elements vary much (Smith) with the season, variety, ripeness, and soil. The nutrient value of the potato is determined by its specific gravity;[2] the heavier any given tuber is according to its size, the greater amount of starch it contains. The relative proportion of solid constituents can be ascertained (Parkes, p. 237) by multiplying the specific gravity by a factor taken from the table,[3] and if it be desirable to ascertain the percentage of starch, multiply the specific gravity by the factor less 7. If the specific gravity of the potato is below 1068, the quality is bad (Parkes).

[1] Percentage amount of ash 1 to 1.5. Mineral constituents in 100 of ash: —

	Way.	Fromberg.
Potash	46.60	50.23
Soda	—	3.7
Magnesia	8.70	4.4
Lime	4.54	0.83
Phosphoric acid	13.30	10.10
Sulphuric acid	4.66	14.67
Chloride of Potassium	—	17.76
Chloride of Sodium	3.43	
Carbonic acid (from the incineration of the organic acids)	13.30	
Oxide of iron	—	
Silicate of Alumina	1.95	

Parkes, *Prac. Hygiene*, 4th ed. p. 236.

[2] This may be ascertained by throwing several potatoes into a strong solution of salt, and then adding water until some of them sink, and others swim. The specific gravity of the solution will represent that of the potatoes as a whole. Smith, *Foods*, p. 199.

[3] Specific gravity between	Factor.	Specific gravity between	Factor.
1061–1068	16	1105–1109	24
1069–1074	18	1110–1114	26
1075–1082	20	1115–1119	27
1083–1104	22	1120–1129	28

Between 1068–1082, the quality is inferior.

Between 1082–1105, the quality is rather poor.

Above 1105, the quality is good.

Above 1110, the quality is best.

The potato should be cooked with the skins on, and well boiled or thoroughly steamed, otherwise the starch is not easily digested; and if the cooking process is rapid, the cellulose and albuminates become hard. For the sick Chambers (*loc. cit.*, p. 244), prescribes the following method: —

"Boil one pound of potatoes with their jackets on till they are tender or brittle. Peel them, and rub them through a fine sieve; when cool, add a small teacupful of fresh cream and a little salt, beating the *purée* up lightly as you go on, till it is quite smooth, and warming it up gently for use."

With a knowledge of the structure and composition of the tuber, it is easily understood why bruising, peeling, germination, and freezing should promote degenerative change. Any change which increases its very large proportion of water diminishes its relative nutritive quality and hastens the destructive process. The tuber should be firm and cut with crispness. The chief value of the potato lies in its anti-scorbutic properties. "Ten grains (Smith) of potato consumed in the body produce heat sufficient to raise 26 lbs. of water 1° F., or to lift 1,977 lbs. one foot."

The pea (*Pisum sativum*), as a fresh vegetable, is eaten unripe, but should have reached the stage of maturity when the seed husk is filled. It, like the potato, comes first from the far south, and successively from nearer regions. As a fresh vegetable they bear transportation badly, soon wilt, heat, wither, shrink, fade, and deteriorate after having been gathered and packed. It is a tedious crop to gather and a bulky product to transport. The producer gathers his table supply during the forenoon, perhaps before the morning sun has evaporated the dew from the leaves and seed-pods. Upon his table the pea is a delicious, inviting, and richly flavored vegetable, seeming to dissolve during the process of mastication, and digests without inconvenience. For the market the crop is more frequently gathered when too far advanced toward ripeness, than before the fitted stage of development, — and for the obvious reason that transportation is better borne and the loss is less from shrinkage. Usually the gathering is done during the heat of the day, because of less injury to the vine while wilting under a blazing sun; but the prudent farmer never enters his pea patch until the gathering is ready for his "pickers" — that is, when the hand can pluck a number of pods at a single grasp, for he wisely estimates the cost of time lost in clutching at single pods, and knows too well that the loss in price by a few days' delay will be abundantly made up by the increased measurement from the too far advanced and ripened seed-pods. Thus gathered, they are immediately packed in barrels and transported to market. Very speedily the heating process begins, and in a few hours the temperature in the centre of such a bulk will rise considerably above blood-heat, and when emptied upon the salesman's stand, the subsequent morning, the loosened bulk will emit an amazing volume of smoke — condensing steam; or perhaps more time has elapsed, and the heating process has been completed, succeeded by other

destructive changes. The seed pods have lost their fresh and pea-green color, their crispness and resiliency, — have faded and withered, flattened as the salesman will tell you, by pressure, but in fact by the loss of natural moisture expelled by *the* steaming process. The contained seeds, the only edible portion, have lost entirely their peculiar luscious flavor, acquired toughness, and, to a greater or less degree, hardness, and the seed husk no longer submits to ordinary digestion. Each seed must be crushed between the molars, or else may roll through the alimentary canal, except for the preliminary cooking, conditioned for a vigorous vegetation. The seed pulp contains all the nutrient qualities, but cannot be separated from the husk in the green state. The husk acquires firmness as the seed pulp progresses to complete development, and loses color through the ripening process. It is better to select for the table undeveloped rather than past developed peas, and small, immature pea-green pods rather than the faded and ripening ones. The peculiar greenish hue is an essential characteristic of freshness.

"They should (Chambers) be young, and their skins tender enough to crack in boiling." In such condition they are sweet, easily digested, but less nutritious than when fully matured. "When old (Chambers, Pavy), no amount of boiling will soften them; indeed, the longer they are boiled the harder they become."

When dried they are deprived of their husks before cooking, and when thoroughly boiled constitute a good article of diet for those blessed with vigorous digestion.

Composition of the Dried Pea (Payen).

Nitrogenous matter	23.8
Starch, etc.	58.7
Cellulose	3.5
Fatty matter	2.1
Mineral matter	2.1
Water	8.3

Beans. — Beans are even more perishable than peas. As a fresh vegetable, both pods and seed are edible, and in their highest perfection for the table they must be young, fleshy, brittle, and tender. The succulence and fleshiness of the pods invite destructive changes, and in bulk, closely packed, rot soon begins. Hence it becomes the interest of the distant grower to delay the gathering beyond the stage of dietary perfection; and, consequently, of the city consumer to purchase his supplies from the growers of his vicinage. They should be packed loosely in small bulk and in crates. A coarse vegetable at best, but nutritious and harmless when in proper condition. They are cheap, and therefore popular among the poorer classes. As the pod ripens color fades, dryness increases, they become tough and tasteless. Cattle will not eat them. Even when gathered in proper condition and properly packed, deterioration soon begins, and though not actually rotten, the loss of succulence and brittleness denotes changes which unfit them for table use.

Beans are sometimes, improperly, eaten as salad, in the preparation of which vinegar should never be used, for it renders the legumin insoluble, and thus prevents digestion.

Composition of Dried Beans (*Payen*).

	Horse Bean.	Windsor Bean.
Nitrogenous matter	30.8	29.05
Starch	48.3	55.85
Cellulose	3.0	1.05
Fatty matter	1.9	2.00
Saline matter	3.5	3.65
Water	12.5	8.40
	100.0	100.00

The leguminosæ are rich in nitrogenous matter, and approximate in nutritive value the products of the animal kingdom. They possess the special advantage of combining sulphur and phosphorus with the vegetable casein, but in consequence of the indigestibility of the legumin about 6.5 per cent. is lost, and escapes with the excrementitious matter, and much flatus (Parkes) is also produced by the formation of sulphureted hydrogen. In combination with other starchy or fatty aliments they constitute valuable articles of diet. Bacon and beans in this country, as in England, has been a favorite dish, especially among the laboring classes, who are accustomed to much exercise and continuous labor.

Tomatoes. — The tomato (*Solanum lycopersicum*), so universally and deservedly popular among all classes of consumers of vegetables, when ripe and gathered and packed with ordinary care, bears carriage well, and is usually supplied to city consumers in great perfection. Those brought, in early spring, from the remote south have been gathered green, are packed with very great care, each wrapped in a separate piece of paper, and are thus ripened on their journey. Those supplied from the near vicinity, after a killing frost has bared the earth of all summer vegetation, have been ripened under glass. When the chilling wind and falling thermometer threaten frost, the grower hastens to save the green fruit upon the vines. They are hastily gathered and put under glass and then colored red, not in fact matured. Such fruit possesses but little of the attractive flavor and nutrient qualities which belong to the matured and naturally ripened fruit, but they find ready sale, and are offered to the consumer in the best condition attainable. It is the business of the producer to supply the demand, and it is no fault of his if the luxurious palates of city consumers are only to be satisfied with green fruit colored red. I regard the tomato as a healthy, agreeable, and nutritious vegetable, but have no confidence in its cholagogue or blood-purifying qualities, as very many of the laity believe and some physicians claim. In the flesh reside all the nutritive and gustatory qualities, hence they should always be peeled preparatory to being eaten. The preliminary degenerative change is fermentive, which rapidly progresses to the complete destruction of all the fleshy part, leaving nothing but the seed and thin but tough skin. Neither seed nor skin are digestible. Feed hogs

upon tomatoes, and scatter the manure from the sty upon a barren field, and tomato plants will flourish like noxious weeds. Commingle the refuse skins with the slop and the hog will carefully avoid them, leaving them in the vessel from which he feeds. Rot will very slowly destroy tomato skins. Throw them into the cess-pool and they will offer an obstinate resistance to the putrefactive process. They disappear through disintegration by dryness. Notwithstanding all this, some foolish people will insist that the choicest part of this popular vegetable is the skin, and not unfrequently I have known young children to be fed upon the sliced fruit without previous peeling or ordinary care to avoid the ingestion of the seed.

The following analysis[1] is by Dr. B. F. Craig of this city: —

"A can of tomatoes was found to contain 2.04 pounds avoirdupois, of which, however, only 0.05 pounds (22.75 grains) were solid matter, dried at 212° Fahrenheit. There was, therefore, 97.6 per cent. of water present.

"The acid of the tomato I found to be malic, with a trace of citric, the amount of the free malic acid being equivalent to 315 parts in 100,000, or a little over three tenths of one per cent. (Lemon juice contains about twenty-five times as much free acid.) In tomatoes there is about as much more malic acid in combination with bases.

"The amount of vegetable acid — its proportion to the total solid matter — is of itself enough to make tomatoes valuable as an antiscorbutic, but it certainly seems desirable, in canning them, to get rid of some of the great excess of water."

Chambers regards the tomato as a healthy but not a substantive article of diet, and Pavy regards it more as a relish than a nutritive aliment. Surgeon Swift would regard it as an addition to the army ration of great value, if the excess of water could be dispensed with.

They may be eaten cooked, or sliced raw as a salad with oil and vinegar; and are easily digested when ripe, but when green are flatulent. Their only medicinal property is exclusively derived from the very limited quantity of malic acid, and it may be defined as mildly antiscorbutic.

Cucumber (*Cucumis sativus*). — Perhaps no one member of the family of kitchen garden vegetables has so many greedy devourers as the cucumber. There is something so refreshing and exhilarating about the appearance of a dish of sliced cucumbers prepared for the table, and something so attractive to the palate in its peculiarly inviting and mouth-watering aroma, that one's self-denial oftentimes fails to protect the stomach from the indigestible mass, and consumers fail to appreciate the fact that they are vigorously masticating an aroma, deriving but little if any sustenance. Why preferred for the table before maturity I do not know. Swine, I believe, select the full-grown and matured fruit, ripened into a golden yellow color, as the choicest, and certainly the aroma is more decided and the juicy constituent is most abundant at maturity. For home consumption, it is gathered in early morning, while chilled by the morning temperature, and either immersed in cold water or kept in a cool place until prepared for the table. Not easily digested at best, yet those who eat them with such avidity are very unwilling to

[1] Circular No. 8, Report on Hygiene, p. xxxix.

acknowledge any after ill effects, and it is assuredly true that country consumers usually escape merited suffering. The cucumber carries well, resists decay, withers slightly, loses some in crispness and brittleness, and acquires toughness, but retains flavor for some days, and is usually offered for sale in a fair condition of preservation. Without presenting the manifest evidences of destructive change, it speedily undergoes some alteration which renders it exceedingly hurtful to healthy digestion, and provocative of intestinal trouble. It would seem that these evil effects were proportionate to the loss of the watery constituent, and thus gathering during the heat of the day, exposure, and the elapse of time, promote those changes which so seriously injure its dietary qualities.

Cucumbers, like celery, says Chambers (*loc. cit.* p. 49), are not suitable for eating raw after a full meal. The quantity of woody fibre in them cannot be digested. "With bread and cheese, as a light lunch, they give an agreeable zest, and seem to stimulate the secretion of gastric juice." "Stewed, they form (Pavy) a light and wholesome vegetable." "When made acid with vinegar and eaten in a large quantity (Smith), they cause pain at the stomach." Some have supposed that the unwholesome property resided in the skin, others located it in the juice. It usually repeats its flavor in the mouth some time after having been eaten.

The brassica tribe, which includes all the varieties of the cabbage, Brussel sprouts, cauliflower, brocoli, and kale, are very highly esteemed as vegetable aliments by very many persons, and especially by the laboring classes, who rank them as highly nutritious, usually styling the cabbage as "strong food." In this respect, however, the popular estimate is far above their true value as food. There may be very wide differences in the chemical composition of the several species of this family of vegetables, but for all practical purposes cabbage may be assumed to represent the type of the class. It contains in 100 parts —

Water	91.
Albuminates	.2
Fats	.5
Carbo-Hydrates	5.8
Salts	.7

"10 grains of cabbage (Smith) when consumed in the body produce heat sufficient to raise 1.12 lbs. 1° F., which is equal to lifting 834 lbs. one foot high," thus representing less than one half the power of an equal amount of potato. Even this very feeble nutritive property varies according to the stage of growth and maturity of the plant. Anderson has determined these variations as follows: —

	Young Plant.	Ripe Outer Leaves.	Ripe Heart Leaves.
Water	91.8	91.1	94.4
Nitrogenous	2.1	1.6	0.9
Woody fibre, gum, and sugar	4.5	5.00	4.1
Ash or salts	1.6	2.2	0.6

It thus becomes manifest that as the plant advances to maturity its nutritive property diminishes, and that the matured and blanched heart leaves, usually selected as the choicest parts, and largely consumed as a salad in the form of "cold slaw," possess but little else than water and woody fibre. The very large proportion of these two constituents not only diminish its value as an alimentary product, but render it very difficult of digestion, and hence inadmissible as an article of diet when the digestion is enfeebled by disease or other conditions. Life could not be sustained but for a brief period upon this class of substances, for the digestion and capacity of the stomach would prove inadequate to the wants of the system. The tribe as a whole may be very properly styled the hay of the human race, but in fact they are less valuable as alimentary substances, containing less oily and nitrogenous material. "Their proportion of sulphur (Pavy) is large, and they thus are apt to give rise to flatulence of an unpleasant nature." For the table they should be young, fresh, and green (brocoli should be white); blanching is the evidence of loss of nutritive qualities.

"If the cabbage has begun to heat from fermentation (Chambers) it is most noxious, and generates in the intestinal canal an enormous amount of flatus, consisting not only of the usual carbonic acid, but of sulphureted hydrogen." Fermentation destroys the antiscorbutic qualities, for which the cabbage is so highly prized, and in which consists its chief value as an aliment. This property diminishes with loss of freshness and crispness.

It is the common belief that cabbage deteriorates very slowly, and this prevalent opinion enhances the cupidity of the tradesman. The purchaser buys the largest head for the smallest amount of money, and distributes his mess of bacon and cabbage through as many meals as his daily subdivisions will admit, and hopes to restore freshness and crispness by continuous immersion in water, forgetting that he is thus diluting his five per cent. solution of woody fibre, and feeding himself on bad water and noxious gases. If one will have cabbage to season his bacon and pork, purchase the heads fresh, unstripped of the green and most nutritious leaves, and buy it daily from the producer, and not from the huckster when old and blanched, with 94 per cent. of water, and but nine tenths of one per cent. of nitrogenous material. On such substances nursing women feed to make rich milk, and puny babies are fed to promote vigor and growth. The disagreeable, penetrating, and tenacious odor of boiling cabbage ought to banish it from the kitchen.

The turnip (*Brassica napus*) belongs to the cabbage tribe. It is less nutritious than the young, fresh, green cabbage, but more so than the matured and blanched heads.

Composition of the Turnip (*Letheby*).

Nitrogenous matter	1.2
Starch, etc.	5.1
Sugar	2.1
Salts	0.6
Water	91.0

One pound of turnips (Smith) contains —

	Swede.	White.
Carbon	30.4 grains	17.3 grains.
Nitrogen	15.3 grains	11.2 grains.

Dr. H. C. Bastian, in his experiments on spontaneous generation, made much use of a solution of turnip, as being an especially favorable medium for the growth of bacteria and other microzymes; and my friend, Dr. J. S. Billings, U. S. A., in repeating Dr. Bastian's experiments, found that bacteria developed more rapidly in a solution of the turnip than in any other medium employed by him. This fact may be of but little value as a proof of the speedy deterioration of the turnip, but in view of other researches, as yet, perhaps, not determinative of any practical conclusion, the interesting inquiry presents itself — what relation does the development of bacteria bear to the degenerative change which vegetables and fruits undergo, and how far such microzymes may be concerned in the causation of disease? Accepting the researches of M. Pasteur, that "putrefaction is a fermentation determined by infusoria of the family of vibrios and by bacteria," and the further conclusion, deducible from the researches of M. Davaine, that septic matter owes its toxic properties to the development of bacteria, it requires but little stretch of the imagination to conceive how purulent infection might follow the introduction into the system of bacteria generated during the process of vegetable decomposition, unless it be maintained that such infusoria differ in their virulence from those of septic matter. This is but a passing suggestion.

Like cabbage, the turnip is not easily digested. Age and germination diminish its nutritive quality and lessen its digestibility. As an aliment it is less valuable than either the carrot or the parsnip.

Composition of the Carrot (*Letheby*).

Nitrogenous matter	1.3
Starch, etc.	8.4
Sugar	6.1
Fat	0.2
Mineral matter	1.0
Water	83.0

"Ten grains of carrot (Smith), when consumed in the body, produce heat sufficient to raise 1.36 lbs. of water 1° F., which is equal to lifting 1,031 lbs. one foot high," exceeding the power of an equal amount of cabbage 197 lbs., and 946 lbs. less than an equal amount of potato.

Composition of the Parsnip (*Letheby*).

Nitrogenous matter	1.1
Starch, etc.	9.6
Sugar	5.8
Fat	0.5
Salts	1.00
Water	82.0

The parsnip and carrot (Smith) require from two and a half to three and a half hours to digest.

Contrary to the popular belief, the turnip, carrot, and parsnip are more easily digested and more valuable as aliments than the cabbage; and it is remarkable that the parsnip and carrot are not more generally used. Both are productive crops, carry well, are easily preserved, and do not deteriorate rapidly. When tough and fibrous they should be rejected. When overgrown, they are apt to be hard in the centre. The carrot is more nutritious in proportion to thickness of the "soft, outer, red, than the central, yellow, core-like part."

The cantaloupe is especially illustrative of the rapidity of deterioration, and of the marked and sudden transitions from the stage of perfect maturity to one of decay, and these changes progress more rapidly if left, after maturity, attached to the vine and exposed to the air and sunlight than when gathered and properly sheltered. The experienced grower knows precisely at what stage of ripening to gather to suit his mode and the distance of transportation. If distant a night's journey in a wagon or a few hours by rail or water, they can be offered for sale in the city in perfection. But there is art in growing as well as tact in gathering the cantaloupe. It should be regular in shape; have a well netted and deeply furrowed surface, and thick rind; possess the well recognized, penetrating, and tenacious fragrance; and be thick and firm fleshed, juicy and high flavored. Deformed and irregularly shaped melons are wanting in flavor; past ripened lose flavor and firmness; insipidity is in proportion to softness and pultaceousness. A deep yellow colored cantaloupe should not be permitted to be sold in any market. In its highest state of perfection, it is delicious, nutritious, and healthy fruit; in its past ripened, decaying condition, very unwholesome. No cantaloupe in a state of perfection to-day can be kept in a proper condition until to-morrow, by any process known to me. The flattened and blanched under surface is always defective in flavor and other essential qualities.

It may be permissible, though not strictly relevant, to refer to the quality especially illustrated by this melon, which, as expressed in ordinary parlance, some fruits and vegetables possess of imparting their peculiar and characteristic flavor, and odor also, to certain oleaginous articles of diet, when packed together in partially or wholly air-tight compartments. It is, perhaps, more properly the absorption by such substances of the volatile oils which give to vegetables and fruits their aroma; and hence the impregnation of milk, butter, and other oleaginous substances, with the flavor of certain fruits and vegetables, is due to the facility and extent of such absorption of the volatile oils. How far this may affect the nutritive and digestible qualities of such articles, I do not know. It may also be added that certain vegetables grown in near proximity reciprocally impoverish the flavor of each — for instance, the squash, pumpkin, or gourd, grown sufficiently near the cantaloupe, will destroy the flavor of the latter.

Fruits. — There are a few general observations applicable to fruits, which I may be permitted to epitomize from the recent work of Professor Pavy,

on "Food and Dietetics." Fruit is a modification of the leaf, and in the green state exhibits much of its chemical composition. As maturity advances, special characteristics develop. At first, like other green parts of the plant, the fruit absorbs and decomposes the carbonic acid of the atmosphere, liberating oxygen and assimilating the carbon. As the ripening progresses, oxygen is absorbed and carbonic acid given out, and some of the proximate principles contained in the unripe fruit, particularly the acids and the tannin, in part disappear, apparently by oxidation. At the same time, the starch undergoestrans formation into sugar, and the insoluble pectose into pectin and other soluble substances. In this manner the fruit arrives at a state of perfection. But oxidation advances, the sugar and remaining acid become destroyed, flavor diminishes, and deterioration sets in ; and if these changes are allowed to pursue their ordinary course, the pericarp undergoes decay, and the seed is set free. It is thus manifest that the stage of complete ripeness is quickly followed by degenerative changes, which rapidly progress to the entire destruction of the sarcocarp, unless, by some method of preservation, the oxidation can be arrested at the stage of ripeness.

Composition of Fruits (Fresenius).

	SOLUBLE MATTER.					INSOLUBLE MATTER.					Variety.
	Sugar.	Free Acid (reduced to equivalent in Malic Acids.	Albuminous Substances.	Pectose * Substances, etc.	Ash.	Seeds.	Skins, etc.	Pectose.	Ash from insol. matter included in weights given.	Water.	
Apples . .	7.58	1.04	0.22	2.72	0.44	0.38	1 42	1.16	0.03	85.04	White dessert.
Pear . . .	7.94	trace	0.23	4.40	0.28	0.39	3.42	0.60	0.49	83.00	Sweet, red.
Plums . .	3.58	0.58	0.19	5.77	0.57	5.78	0.17	1.08	0.08	82.25	Com. Yellow.
Cherries . .	13.11	0.35	0.90	2.28	0.60	5.48	0.45	1.45	0.90	75.37	Sweet, red.
Apricot . .	1.14	0.89	0.83	5.92	0.82	4.30	0.96	0.14	0.07	84.96	
Grapes . .	13.78	1.02	0.83	0.49	0.36	–	2.592†	0.94	0.11	79.99	White Austrian.
Gooseberries	8.06	1.35	0.44	0.96	0.31	2.48	0.51	0.29	0.14	85.56	Large red.
Currants . .	5.64	1.69	0.35	–	0.62	–	3.940†	2.38	0.18	85.35	Large red.
Strawberries	7.57	1.13	0.35	0.11	0.48	–	1.96†	0.90	0.15	87.47	Large red.
Raspberries .	4.70	1.35	0.54	1.74	0.48	–	4.106†	0.50	0 29	86.55	Red, cultivated.
Blackberries	4.44	1.18	0.50	1.44	0 41	–	5.210†	0.38	0.07	86.40	Very ripe.
Mulberries .	9.19	1.86	0.39	2.03	0.56	–	0.905†	0.34	0.08	84.707	Black.
Bilberries .	5.78	1.34	0.79	0.55	0.85	–	12.864†	0.25	0.55	77.55	
Peach . . .	1.58	0 61	0.46	6.31	0.42	4.62	99.‡	–	0.04	84.99	Large Dutch.

Composition of the Pulp of Ripe Bananas.

Nitrogenous matter	4.820
Sugar, pectose, organic acid, with traces of starch .	19.657
Fatty matter	0.632
Cellulose	0.200
Saline matter	0.791
Water	73.900

* Of, or belonging to pectin, or vegetable jelly.

† Aggregate of seeds and skins.

‡ Aggregate of pectose and skins.

These analyses show that fruit, in consequence of the small quantity of nitrogenous matter and the very large proportion of water which it contains, is not entitled to very high rank as a nutritive aliment. "Whilst advantageous (Pavy) when consumed in moderate quantity, fruit, on the other hand, proves injurious if eaten in excess, of highly succulent nature, and containing free acids and principles prone to undergo change, it is apt, when ingested out of due proportion to other food, to act as a disturbing element, and excite derangement of the alimentary canal. This is particularly likely to occur if eaten either in the unripe or overripe state: in the former case, from the quantity of acid present; in the latter, from its strong tendency to ferment and decompose within the digestive tract."

The cultivated fruits are more nutritious than the wild, the quantity of sugar being considerably augmented, and the amount of insoluble matter, skins and seeds being greatly lessened by careful cultivation. To the succulence is due the rapidity of degenerative changes. Berries and cherries soon ferment; the latter even when fresh are apt to disorder the bowels.

The strawberry season does not properly, in any particular locality, extend beyond thirty, but in our northern cities it not unfrequently runs through sixty, and perhaps even ninety, days. Since the introduction of improved varieties and more intelligent culture, with careful gathering, and packing in small open baskets in crates, favored by the rapidity of transportation, the berries can be supplied to consumers at great distances from the localities where grown, in a condition quite equal to the demand of a prudent and healthy consumption. Good strawberries should be plump and firm, with a dry and unbroken surface, and should not be separated from the cap until prepared for use. Rough and unnecessary handling, bruising, moisture, and bulk promote fermentation and speedy decay. Capped berries will not long resist destructive change, and neither bulking on the salesman's stand, nor sale by any fixed measure, should be permitted in any market.

Strawberries, like all very small seeded fruits, not excepting the blackberry, so much valued by many for its alleged astringent properties, are laxative in their tendency. The seeds are absolutely indigestible, and pass through the bowels uninjured by the digestive fluids. To this quality, to their locally irritating influence upon the mucous membrane of the alimentary tract, and to their liability to cling to the folds of, and find lodgment in the innumerable crypts of the membrane, add the deleterious influence of the fleshy part in a state of fermentation and decay, and surely nothing more is needed to admonish you of the danger of ingesting such deteriorated fruit. Especially objectionable are these small seeded fruits to young children, to whom they are frequently fed during the period when the follicular apparatus of the digestive tract is undergoing rapid evolution, and perhaps disturbed in its normal progress by some one or more of the coincident developmental operations. Strawberries contain much less insoluble matter (seeds and skins), and much more sugar, than either the blackberry or raspberry; carry better than the latter, and equally as well as the blackberry. The raspberry when fully ripe degenerates very soon and rapidly after being gathered and packed for market, and is very rarely

offered for sale before deterioration has commenced. This is due to the delicacy of the skin and the absence of the caps, which render it easily compressed by light pressure and careless packing. It bears transportation badly, and only when packed in very small bulk.

The tendency of the berry family[1] to speedy fermentation, when packed for transportation, is due to the large proportion of free acid, structure, and delicacy of skin which does not afford protection against injury from even very light pressure and very careful handling. This tendency is specially manifest in the raspberry and mulberry.

These analyses do not sustain the popular estimate of the relative nutritive value of several varieties of fruits. The peach and apricot, so universally esteemed because of their luscious flavor and comparative easy digestion, are in fact less valuable than others less attractive and palatable. Like the plum and the pear, they are rich in pectous substances, which mask the free acid, but do not add much to their alimentary value. Wholesomeness is not necessarily in proportion to the nutritive value, but to the digestibility and adaptation to the condition and wants of the animal economy.

In the table below, the proportions of soluble and insoluble constituents, and of the seeds and skins, have been arranged so as to exhibit with approximate accuracy the relative value as aliments of the several kinds of fruits. The table is based upon the assumption that in the soluble elements reside, for the most part, if not entirely, the nutritious properties. The seeds and skins are insoluble, and but partially, if at all, digestible. As aliments, each kind must be considered not only in reference to the relative proportion of soluble and insoluble constituents, but in regard also to the proportion of

Proportions of Soluble and Insoluble Constituents.

	Apples.	Pear.	Plum.	Cherry.	Apricot.	Peach.	Grape.	Gooseberry.	Currant.	Strawberry.	Raspberry.	Blackberry.	Mulberry.	Billberry.
Soluble .	12.	12.85	8.69	17.24	9.60	9.38	22.37	11.12	8.30	9.64	8.81	7.98	14.03	9.31
Insoluble .	88.	87.15	91.31	82.76	90.40	90.62	77.63	88.88	91.70	90.36	91.19	92.02	85.97	90.69
Seeds & Skins	1.80	3.81	5.95	5.93	5.26	5.61	2.59	2.99	3.94	1.96	4.10	5.21	0.90	12.86

seeds and skins which is necessarily ingested with the soluble and nutritive elements. The peach contains 9.38 per cent. of soluble constituents, and 5.61 per cent. of seed and skin, but the latter are usually removed from the edible portion, whereas the gooseberry contains 11.12 per cent. of soluble material, and 2.99 per cent. of skin and seed, which, as a rule, are never removed, but ingested with the pulp, and consequently, while richer than the peach in nutritive properties, it is less wholesome, because of these indigestible constituents. The strawberry contains 9.64 per cent. of soluble elements, but 1.96 per cent. of seeds and skin, and 1.13 per cent. of free acid, and must be accepted as the healthiest of the berry family, notwith-

[1] Strawberries, raspberries, mulberries, and blackberries are not properly berries, though classed as such here.

standing the mulberry is richer in soluble constituents, and contains but .90 of seeds and skin. The large proportion of free acid in the mulberry (1.86), though masked by 2.03 per cent. of pectous substances, promotes speedy fermentation, and even when eaten freshly gathered from the tree, this action is set up, usually speedily followed by some derangement of the bowels.

If the nutritive value of the several varieties of fruits is estimated according to the amount of nitrogenous matter (albuminates) each contains, it is very little, and would vary between .90 per cent. found in the cherry and .19 per cent. found in the plum. The cherry and the grape are richest in nutritive properties, in soluble constituents, and contain less water, yet there is a great difference in their wholesomeness as aliments. The grape contains but .49 per cent. of pectous substances, but is ingested without the skin; the cherry contains 2.28 per cent. of pectous substances, and is eaten with the skin; but the skin and seed of the grape does not aggregate more than half of the percentage of the skin and seed of the cherry. Whether the difference in digestibility is due to the difference of chemical constitution or to the parts ingested, has not been determined, but it suggests more care in avoiding the ingestion of the seeds and skins of fruits.

Grapes bear transportation well in unbroken bunches, cherries badly at best, but should never be detached from the stems until being eaten.

These examples are believed to be sufficient to satisfy you of the necessity of the inquiry to which I invite you; but, as yet, the picture is far from complete. Before proceeding to describe the process of *freshening* stale vegetables and fruits, now so generally practiced by the market dealers, I must briefly refer to the market system in operation in many American cities, which I hold is not only wrong in itself, but productive of greater wrong upon the communities.

Market Systems. — In many of the large cities of this country there is a class of dealers, generally known as "hucksters," who stand between the producer and consumer. They purchase from the producers fresh vegetables and fruits in large quantities, at prices far below the rates paid by consumers, always overstock themselves in quantity and variety, preferring to carry over to another market day the surplus rather than lose the opportunity of accommodating a customer. Having, by a system of market regulations established by municipalities in their generous zeal to promote business and to foster trading, secured, through the payment of a bonus, the right of occupancy, upon the payment of an annual rental, all the stalls in the regular market places allotted to the sale of fresh vegetables, they establish a monopoly so exclusive that the husbandman cannot penetrate any nearer than the nearest curb line or foot-walk, and there, if at all, offer his products for sale, otherwise he must compete with the monopolist at public auction, in bonus bidding, for a suitable stand under shelter. The huckster's capital consists in his right of occupancy thus secured, perhaps a horse and wagon and a very small amount of money. He purchases to sell and promises payment after sale. Competition is consequently not between the dealers to secure the choicest and freshest products, but between

the growers to secure a purchaser. Far from his garden with his wagon and team, he wisely submits to a sacrifice rather than return with his perishable commodities. This bidding for a purchaser does not enure to the benefit of consumers ; it simply enhances the profits of the dealers. Hucksters have little or nothing at risk, and deal exclusively for the profit, and if supplied from the surplus of the previous day buy only to freshen their wilted and decaying stock. In brief the system, —

1st. Regulates the supply by separating the producer from the consumer.

2d. Enhances prices to the consumer, without benefiting the producer.

3d. Compels consumers to purchase stale if not deteriorated vegetables, because the supply is controlled by middlemen, and not by amount produced.

4th. Supply and demand do not bear their proper trade relationship, because supply can only reach consumers through middlemen who control the only channels of trade.

5th. Consumers cannot make quality a basis of value, for the good and bad are mixed. The fresh is made to sell the stale.

"*Freshening*" *Fruits.* — The system of freshening green vegetables is extensively employed by many dealers in perishable vegetables and fruits, and is so cunningly devised and adroitly executed that it will escape any but the most careful and cultivated observation. It can be most practically exposed by individual and descriptive illustrations. Cabbage and lettuce are freshened by stripping off the external layer of leaves and clipping the end of the foot stalk, and this process is repeated from time to time until the head is either sold or is so reduced in size as to become unmerchantable. The process of stripping brings to the exterior the blanched and whitened leaves, and it oftentimes happens that the blanched head most eagerly sought has been stripped sundry times, and while its surface is apparently fresh and crisp the centre is in a state of decay. Cabbage at certain seasons of the year will bear this process without rapid deterioration, but lettuce is much more perishable. Beets, radishes, and other roots which are offered for sale bunched, speedily deteriorate in moderately warm weather. This begins first at the circumference of the leaves, and actual decay at that part of the leaves and midribs compressed by tying, hence freshening is performed by clipping or tearing off the faded parts, and this process is repeated until the midrib is cut short to the crown, and then they are either bunched by the extremities of the roots or sold by measure, so that not unfrequently the fresh beets upon our tables in May and June have been hauled from market to market for a week or more. Peas and beans are offered for sale bulked upon the market stand, and the salesman always measures from the bottom. The surplus from previous sale days is heaped upon the stand, and the entire surface neatly and adroitly covered with a sufficient quantity of the more recently gathered. Great taste is displayed in making the stale surplus look attractive, and much tact is acquired in measuring so as to disturb the surface but little and secure for the purchaser the full measure of the underlying deteriorated legumen. Spinach and kale, after the first rush of the season is over, are generally so cheap as to render

the freshening process unremunerative, but when dear the latter is freshened by clipping or tearing off the faded parts of the leaves, reclipping the foot stalks and sprinkling. Spinach in cold weather can be preserved in a fair condition for some days. But did it never occur to you that a crop which is left standing in the open ground during winter could not be gathered in such quantities as is sometimes offered in the markets during hard weather, when the surface of the ground is covered with a foot of snow for weeks and sometimes months? The salesman will tell you the crop was protected with a layer of straw or thick brush, and by removing this it was easily gathered. And so far he tells the truth, but if you undertake to remove straw loosely spread upon the earth and covered by six or twelve inches of frozen snow, you will soon learn it is far from an easy task. The truth is, the crop is gathered before the snow falls, kept in a cool, secure place, and retained frequently until the price rules high.

"Unfortunately dead plants (Chambers) do not stink early enough to disgust the nose; but yet, every minute they are kept after their actual death, — that is, after they have ceased to be capable of growth, — renders them in some degree less digestible. Sometimes they are kept too long out of mere carelessness, sometimes from lack of sale, but sometimes also intentionally, to make them look better at table. For a long time I could not make out why London asparagus so often disagreed with people, till at last I caught a gardener cutting it twenty-four hours before it was wanted, and putting it in a damp warm frame, 'to swell,' as he said. Cucumbers and brocoli are often spoiled in the same way. The vast wagons of cabbage that one sees coming into London at midnight are often the bearers of two or three days' cutting in small gardens, kept till a full load is accumulated for a single journey. Sprinkled with water they look well, but never regain their fresh character. They ferment in the stomach and produce flatulence."

Strawberries, raspberries, and blackberries are offered for sale either in bulk or in pint or quart measures as transported. If in bulk, the freshening process is executed in the same manner as other products offered for sale in like manner, by carefully concealing the stale and deteriorated surplus from previous days by a neatly arranged surface covering with fresh fruit from the near gardens. And great care is exercised in properly placing each berry so as to thoroughly hide the underlying fermenting mass. If in baskets, the top is dressed with fresh fruit and without loss of measure. A dealer can purchase a crate containing fifty quart baskets of strawberries from a producer, empty them upon his stand, refill each basket by placing every berry, undersell the producer standing alongside, and make money. His baskets will be "heaping full," and each berry will present a bright glossy fresh surface to the purchaser, while the producer's lot will have sunken below the margin of his baskets, and the surface of the topmost layer of berries will have lost glossiness. Thus the baskets are freshened.

I may be mistaken, but my casual observations lead me to the conjecture that illy formed and defective fruit is frequently the result of imperfect and

deficient fecundation, and I have sometimes thought we might apply certain phenomena, which are constantly occurring in the vegetable kingdom, to the study and elucidation of the cause of monstrosities in the animal.

Certain conditions are essential to secure complete fecundations of fruit and grain bearing plants — sunlight, a certain amount of warmth and humidity of the atmosphere, requisite moisture and fertility of the earth, and adaptation of the soil to the vegetable growth. Cold, dashing rains falling at inopportune times, by washing to the ground, and continuous blasts of wind, by blowing away the pollen granules, seriously interfere with perfect fecundation. For instance, I have seen two fields of wheat, each on opposite sides of the same road, or adjoining, with like exposure, and growing upon soil presenting no obvious differences, one yielding abundantly, the other but a scanty crop. The latter had been caught just at the stage of full bloom by a rain and wind storm ; the other escaped because it was either in advance or behind its neighboring field in growth and development ; and, again, when I have seen one field yielding heads of wheat with a full plump grain for each ovum, and an adjoining, or other stalks in the same field, and springing with other spears from the same root, yielding heads with light and shriveled and absent grains, I have inferred that in the first fecundation was complete, in some incomplete, and in other germ cells it failed entirely. In this suggestion I antagonize the accepted views of agriculturists, who so generally attribute these defects and failures alone to atmospheric and climatic influences operating during the stages of devel opment and ripening.

Impregnation of the seed-bearing flowers, or its equivalent organ, is absolutely necessary in all grain-bearing plants, or else the product will be a failure. When single spears of corn stand alone, the ears never fill, because the pollen from the top-gallant fails to reach every germ cell through the silk ; and if two rows of corn, each of a distinct variety, be planted alongside, every ear will contain grains of both varieties more or less distinctly marked ; but if from any cause any part of the silk of any incipient ear be destroyed previous to fecundation, no grains will be developed in the cells connecting with such injured silk ; and imperfect impregnation will find many illustrations in the illy formed and defectively developed grains.

All flowers are sexual, being furnished with the fertilizing or fertile organs, or bisexual, possessing both stamens and pistils, varying in number from a single stamen and pistil to an indefinite number of each. In all fruit-bearing plants complete fecundation is essential to the perfection of the seed, and, as it is a rule with but few exceptions, that the full development of the sarcocarp is concurrent with complete maturity of the seed, it is manifest that the perfection of the latter, like the perfection of the seed, must depend upon proper fecundation. The first dropping of young fruit, which even after an abundant show of blossoms, sometimes extends to the whole orchard crop, is, says Watson, mainly due to the imperfection or total failure of the fertilization, whether this arises from drought and glaring sunshine, from unseasonable cold, an inopportune storm, or from other less manifest causes ; all such dropped fruit is seedless or germless. Again, as

it will occasionally happen, a fruit grown among a number upon the same tree, will be seedless, and invariably such a fruit will be deficient in development — if not illy formed, certainly diminutive in size. Neither the cucumber nor the cantaloupe will fructify under glass, except by the actual and artificial contact of the staminate with the pistillate flower, even though the requisite conditions of humidity, temperature, sunlight, adaptation of the soil, and vigorous growth may all be present. The plants are monœcious, and the sexually distinct blossoms grow in near proximity, yet the crop will prove a signal failure unless artificial impregnation is carefully executed; and this is true of all fruit-bearing plants unless the fruit-bearing blossom is bisexual. Hence, it is evident that some condition, which pertains exclusively to the open air, is essential to complete fecundation in the monœcious and diœcious plants.

The strawberry plant presents itself in distinct staminate and pistillate varieties, and with bisexual flowers. If you destroy in irregular patches the pistils projecting in great numbers from the exterior surface of the ovum of a pistillate variety, or in like manner occlude the stile tubes, each one of which communicates with a germ cell, and leave the undisturbed pistils and stile tubes in near proximity to a staminate flower, those parts of the fruit will fecundate and develop to maturity, whereas the parts connecting with the destroyed pistils or occluded stile tubes will remain undeveloped, and the fruit as a whole will be illy shapen and deformed. Most of our fruit-bearing trees have perfect bisexual blossoms, with more than one stamen and a number of pistils; hence, reasoning from analogy, I have reached the conclusion that knotty, irregularly shapen, and defectively developed apples, pears, peaches, and other fruits, result from defective and imperfect fecundation.

If these suggestions and observations are entitled to consideration, and worthy of being classed as facts, surely I have established the proposition that defective development in fruits is in a measure due to imperfect fecundation. I shall not, at present, undertake to estimate their value in determining the nature and causes of the degenerative changes which speedily take place in fresh fruits, nor the effect of such imperfectly developed fruits when consumed as food.

The final considerations relate exclusively to the remedy for the imposition practiced in the sale of fresh vegetables and fruits. A system of competent inspection will undoubtedly accomplish much, and correct many of the alleged abuses, and not only must the plan be wisely regulated, but the officials must be persons skilled in the art of gathering and packing, and in the transportation of perishable fruits and vegetables. No mere novice who has passed a lounging life in a city, absolutely ignorant of the essential qualities of fresh fruits and vegetables, too weak to resist temptation, and too timid to fearlessly discharge a disagreeable duty, would accomplish any good. To this must be added the right of confiscation. The enormity of the crime must be brought directly home to the practical and pecuniary necessities of the offender. The business of huckstering can be conducted in a proper manner with profit, and I would

rather not believe that every man engaged in the business resorts to the tricks of the trade.

But the most effectual means for the accomplishment of satisfactory results will be the establishment of free market places for the accommodation of the producers. Afford ample opportunities for the utilization of the products of his labor, and cease compelling him to sink his scanty earnings in the enormous profits of middlemen. The perishable products of the farm are introduced into cities for immediate consumption, and every obstacle which obstructs the ready access of the consumer to the producer should be removed, and municipalities should abandon such sources of revenue. Thus may value be enhanced to the producer and diminished to the consumer. Quality will be improved and health promoted.

REPORT ON THE EMPLOYMENT OF POISONS IN AGRICULTURE AND HORTICULTURE: TESTS OF THEIR EFFECTS ON FOOD-VEGETABLES.

By Prof. R. C. Kedzie, M. D., *Agricultural College, Mich.*[1]

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 10, 1875.

In the constant warfare which the farmer is compelled to wage with his insect-foes, he often finds that the only available means of defense is the use of poisons. But in the use of such destructive agents, not only the immediate benefits should be considered, but also the remote and contingent consequences. It seems to me that the following properties would be necessary in a safe insect-destroyer: —

1st. It should, in small quantity, effectually destroy the insects.

2d. It should be easy of application.

3d. It must not injure the crop in any way, or endanger the health of those who consume the crop or any part of it.

4th. Nor must it injure any succeeding crop.

5th. It must not injure the person who applies the poison to the crop.

6th. It should possess such physical properties as will at once distinguish it from other substances used on the farm or in the household.

If we could find any substance which combines all these qualities, it would be a great boon to agriculture. A large number of substances have been used as insect-poisons, but in this paper I shall confine my attention to arsenical compounds. In agriculture, arsenic is usually employed in one or other of these three combinations; namely, the "White Arsenic" of the shops, or the Arsenious Trioxide of the chemist; the Arsenate of Soda, and the Aceto-Arsenite of copper, commonly called "Paris Green." All of these arsenical combinations are deadly poisons to the animal system. So far as their poisonous properties are concerned, there is but little choice, save in the amount of arsenic they contain and the readiness with which they may enter into solution.

White Arsenic is used to some extent by the gardener to destroy weeds and grass in garden walks, but, so far as I am aware, it is not extensively used as an insect poison. I consider it more dangerous than some other forms of arsenic, because there is nothing in its appearance or sensible properties to distinguish it from other and innocent articles found in the household. We often hear of most disastrous consequences, from arsenic being used instead of some innocent substance for which it was mistaken.

[1] This Preliminary Report by Professor Kedzie is submitted with the consent of the Committee appointed by the Association in 1874, to investigate this and other subjects concerning the employment and sale of poisons.

If every farm-house in the land contained this deadly but innocent-looking material, such fatal mistakes might be much more frequent.

ARSENATE OF SODA has not been in very extensive use as an insect-destroyer, but a mixture of Arsenate of Soda and common salt is now prepared at the Lodi Chemical Works, and advertised as a "Potato Pest Poison." I consider this substance a very dangerous one to have on the farm or in the household. It looks and tastes very much like a very innocent substance found in every household; namely, common salt. If the housewife should find some of this substance and not know what it is, she might apply the simplest and most natural test by tasting it, — and finding only the taste of common salt, she might use it in preparing food, with the most deplorable consequences. So also if cattle or other stock gained access to this material, they would eat it readily for the salt it contains, with almost certainly fatal consequences. I can scarcely conceive of a more dangerous combination to have on the farm or in the household. "Paris Green" would be far less dangerous, because its bright green color would at once distinguish it from all innocent substances in ordinary use. If Arsenate of Soda is to be used in agriculture, it should be combined with some substance which will readily distinguish it from all innocent substances, and not combined with so common a substance as common salt.

PARIS GREEN has been more extensively used as an insect-destroyer by the farmers of this country, for a few years past, than any other substance. This material is known in Europe as "Schweinfurt Green," or "Vienna Green." It is an Aceto-Arsenite of Copper, and when pure contains what is equivalent to 58.6 per cent. of Arsenious Trioxide, or "White Arsenic." It is seldom found pure in the market, being usually adulterated with Sulphate of Baryta. A quantity in my possession, which I have used in my experiments, contains 12.4 per cent. of Sulphate of Baryta. Another specimen which I examined contains 42.9 per cent. of barytes. The strong coloring property of the Aceto-Arsenite of Copper enables the dishonest dealer to largely adulterate the article without danger of detection, except by chemical examination. The active agent is the Arsenite of Copper, the Sulphate of Baryta being quite inert; and the activity of the poison will be proportional to the amount of this Salt of Copper which is present. It will be evident that in this salt we have two active mineral poisons — copper and arsenic, but the most abundant and much the most energetic poison is the arsenic which it contains.

If we compare these three arsenical combinations by the criteria which I have proposed for a "safe insect poison," we find that they comply with the first condition, for even in small quantity they will destroy insects; they comply, in a measure, with the second condition, for they are not difficult to apply; their relations to the third and fourth conditions I will consider hereafter; with the fifth condition they do not comply, for they are very liable to poison those who apply them to the crop, especially if handled carelessly; in regard to the sixth condition these substances differ greatly, because "White Arsenic" and Arsenate of Soda do not possess such physical properties as will at once distinguish them from many substances used on

the farm or in the household. In this respect the "Paris Green" is very much safer than these other arsenical preparations, for its color will instantly distinguish it from all substances in ordinary use in agriculture. If we must use a poison in agriculture, it should be a material which we shall at once recognize as unusual — incapable of being mistaken for innocent articles in use. In this paper I shall direct my attention mainly to this *safest of dangerous compounds.*

The amount of Paris Green annually used as an insect-poison. The amount of Paris Green which has been used in the western and northern States for the destruction of the *Doryphora decem-lineata*, or Colorado potato-beetle, is simply enormous, and, in the season of its active growth, the demand for this poison often exceeds the supply. In 1873 more than a ton was sold in the city of Lansing, and the amount used in our State for that single year was probably in excess of one hundred tons! No ordinary exigencies could justify the use of such vast quantities of so active a poison, but the farmers had no ordinary foe with which to contend.

The march to the Sea. The *Doryphora*, in his famous march from the Rocky Mountains to the sea, has swept a breadth of country, has met and conquered an army of foes, and moved with a leisurely triumph that throws into the shade Sherman's historical "March to the Sea." The Rebels never mustered an opposing force so great, or resorted to tactics so desperate as the army of farmers have employed to arrest and destroy this hated insect. No scruples have arisen about cutting off supplies, poisoning food, or killing prisoners in this war. But the insect has conquered, for the *wings* of this army already touch the sea, and European nations have adopted stringent measures to prevent their being outflanked by this beetle! No wonder that the farmer has been ready to use any and all means of defense against so ruthless a foe.

The use of Paris Green in the South to destroy the cotton-worm bids fair to equal its use at the North against the potato-beetle. The annual use of hundreds, or even thousands of tons of this poison, North and South, is a matter to awaken grave concern, and the sentinels of the public health do well to ask what will be its influence on the people both now and in the years to come. In this connection many questions press upon our attention. What will be the influence of this poison on the plants to which it is applied? Will it poison the crops so as to destroy their value as food? Will it poison the soil so that crops hereafter raised on this soil will be injured in quality or rendered unfit for food? Will it be washed out of the soil and thus poison our wells and fountains? What becomes of Paris Green in the soil?

Substitution of Elements. Vegetable Physiologists inform us that in plants one elementary substance may be in part replaced by an allied substance. Thus potassium and sodium have been supposed to mutually replace each other to a limited extent in the plant. Chemists recognize a close relationship between phosphorus and arsenic; their combinations with other substances have a close similarity; they are chemically similar substances. Under agricultural conditions that afford a sufficient supply of

arsenic to the growing plant, the dark suspicion arises that arsenic may in part replace phosphorus in the composition of the nitrogenous constituents of food, and in this way, instead of ministering to the highest wants of animal life, namely, the repair of nervous and muscular tissue, the nitrogenous portion of food may become the vehicle of deadly poison.

Influence of Arsenic on Plant Life. With the exception of Professor Edmund Davy, of Dublin, who made many experiments on the action ot arsenic on turnips, peas, and cabbages, all experimenters agree that arsenic is equally poisonous to vegetable and animal life. The remarkable statements of Professor Davy in 1859 — that pea-plants were repeatedly watered with a saturated solution of arsenious acid without destroying life, and that analysis of such pea-plants showed sensible quantities of arsenic in all parts of the plant; that a cabbage raised on soil heavily manured with superphosphate of lime containing arsenic, was healthy in appearance, though it contained so much arsenic that 113 grains of the head of the cabbage were sufficient to give the most distinct indications of the presence of arsenic; and finally, that turnips raised on soil dressed with superphosphates gave most unmistakable evidences of having been arsenated, and that this quantity of arsenic may accumulate in the system till its amount may exercise an injurious effect on the health of man and animals, were so opposed to the experience of all preceding experimenters, and were so alarming in their nature as to demand immediate and vigorous examination. The statements of Professor Davy have been experimentally examined by Ogston, and by Daubeny and Brodie, who completely refuted many of the statements of Davy, and threw great doubt upon the accuracy of the remainder. Ogston found that watering strong cabbage plants with a saturated solution of arsenious acid killed them in a week; that the leaves of these plants did not contain a trace of arsenic, and that this substance was only found in the portion of the stem close to the roots, which was darkened in the interior. When plants were watered with solutions of arsenious acid so dilute as to produce no bad effect on the appearance of the plant, no arsenic could be detected in any portion above the ground. Daubeny and Brodie came to similar conclusions in regard to barley and turnips. The common practice among gardeners of sprinkling arsenic on garden walks to kill weeds and grass, is a familiar illustration of the fatal influence of arsenic on plants. Mr. McMurtrie, Chemist to the Department of Agriculture, in the Report for May and June, 1875, gives the results of some very interesting experiments on the absorption of arsenic by pea-plants, and he could find no proof that arsenic was absorbed by this plant. It may be objected that the testimony which has been adduced to disprove the statements of Professor Davy is only negative: that Davy says he found arsenic under certain conditions in plants, while the others say they did not find it under similar conditions — and that no amount of negative testimony can refute the affirmative testimony of a credible witness.

Negative Testimony in Science. In the discussion of scientific subjects we often hear of "negative results," "negative testimony," and we are apt to regard such testimony in much the same light as when received in courts of

law. A witness swears that he saw the prisoner steal a certain article ; the prisoner offers to produce twenty as good witnesses who will swear that they did not see him steal the article, but no judge would discharge the prisoner on such testimony. But if these twenty witnesses had had the same opportunity for observation as the first one, and their attention had equally been directed to the fact, and they were equally competent witnesses as the first, then their negative testimony becomes as trustworthy as his affirmative testimony. In the testimony to an historical fact, the fact from its very nature has passed beyond recall, and we can receive the testimony only of those who witnessed the fact. But in scientific discussions the conditions of the fact may again be brought under review in all their essential conditions, and the credibility of the testimony rests entirely upon the competence of the witness. For these reasons, negative testimony in the court of science may have equal weight with affirmative testimony, and we must guard ourselves against rejecting such testimony. The results of Professor Davy's experiments were in direct conflict with those of his predecessors and contemporaries, and thus were a direct challenge to the chemists of Europe, and would naturally provoke a rigorous examination. But I find no evidence that any chemist, on repeating his experiments, has verified his results, and I think I am justified in saying that Professor Davy's statements on this subject are not accepted as reliable by European chemists.

Will Paris Green poison Plants, and will it reappear in those Parts of Plants usually employed as Food? By repeated experiments, I have found that Paris Green, when applied in large quantity to potato vines may kill the leaves, and even destroy the entire plant. This result is reached only when large quantities of the poison are used. Applied in small quantities, these results seldom are observed. A much more important question is, Will it reappear in the tuber and destroy its value as food?

Four years ago, aided by my assistant, now Professor of Chemistry in the State Agricultural College of Kansas, I made a careful investigation to determine whether the potato tuber absorbed arsenic when Paris Green was applied to the vines to destroy the potato beetle. I took potatoes raised in the ordinary course of field culture, but whose vines had been repeatedly dusted with Paris Green, and others to which all the Paris Green had been applied that could be used without destroying the plant, but in no instance could I find a trace of arsenic in the tubers. Other chemists have made similar investigations with similar results. The people in a large number of Western States have for years been consuming potatoes to whose growing tops Paris Green has been freely applied, without a single instance on record of poisoning by the use of such potatoes as food. In the circulars annually sent out by the State Board of Health of Michigan to more than one thousand clerks of local boards of health, inquiry is made in regard to the use of Paris Green to destroy the potato-beetle, and statistics are called for, of any case of death or sickness that could be attributed to that poison. In 1873, returns were received from five clerks of such local boards giving statements of poisoning by Paris Green, but no particulars of such cases of poisoning. I wrote to these five clerks for further information, and I give

their replies in full.[1] I call attention to the significant fact that only five clerks out of more than a thousand made returns of cases of poisoning of any kind by Paris Green.

[1] *Answers of Correspondents.* The following replies to letters of inquiry were received from the five Clerks of Local Boards of Health who reported cases of poisoning by Paris Green in 1873:—

FAIR GROVE, *September* 16, 1875.

R. C. KEDZIE, M. D.

Dear Sir: In answer to your communication of the 9th instant, I respectfully say that the cases of sickness caused by Paris Green were from getting the poison in sores by careless handling. One was my own case: — a little sore on the hand swelled enormously, but was subdued by an application of vinegar and salt. Two others were quite similar. I know of no cases where the poison was inhaled, or where injury resulted by using vegetables to which the Green had been applied.

[Signed] D. E. CRANSTON.

GANGES, *September* 13, 1875.

R. C. KEDZIE.

Dear Sir: Yours of the 9th instant is received, and contents duly noted. In reply, I would say that among the cases reported in last report of poisoning by Paris Green, one was my own, and was from inhaling while applying to the potato tops, resulting in much pain in the head and copious discharge at the nose for about two weeks.

I have been subject to catarrh since childhood until the effects of the Paris Green left me, but have not suffered from that disease since.

The other case I reported was one of my neighbors, who was poisoned by applying the Green: a small hole in his boot-leg admitting the poison, causing inflammation to a considerable extent, which was overcome in a short time by applying house-leek, or "live-forever."

There have been no cases of poisoning from eating potatoes to which Paris Green has been applied, as far as I know. The people of this township raise a great amount of potatoes, and of course use a great deal of Paris Green, but we consider that applying it to the tops of growing potatoes is not liable to poison the bulb.

[Signed] JOHN H. BALDWIN,
Clerk.

HOME, NEWAYGO CO., *September* 23, 1875.

Sir: Yours of the 9th instant, inquiring about a case reported in 1873 concerning Paris Green poison is at hand. I would say, in reply, that the particular case has passed out of my mind, and I cannot say who it was or how the poisoning occurred, and on inquiry I cannot find the case. Do not know of any one poisoned by eating potatoes upon which Paris Green has been used.

[Signed] J. CHAPMAN,
Clerk of Board of Health.

WHITE LAKE, *September* 16, 1875.

R. C. KEDZIE.

Dear Sir: The case of poisoning you refer to was caused by sowing Paris Green and plaster broadcast over the potatoes. The man put a veil over his face, sowed about four acres, and by that time he found he had inhaled so much of the poison that he was in need of a doctor, and got one just in time to save his life, but was sick about two weeks.

[Signed] JAMES FAIR.

NEW HAVEN, *September* 15, 1875.

R. C. KEDZIE.

Dear Sir: Your favor received, and contents noted. I do not remember the circumstances under which the cases of poisoning by Paris Green took place, but think that it was the effects of children playing among vines saturated for the purpose of destroying potato bugs.

[Signed] C. E. FENTON.

Cases of poisoning by Paris Green being inhaled or otherwise brought in contact with the human system are, unfortunately, not infrequent. When we consider how carelessly this material is handled by farmers, I confess I am surprised that so few cases of poisoning are reported. But the important fact that I would call attention to is that no cases of poisoning by use of potatoes to whose growing tops the Paris Green had been freely applied, are reported by the clerks in more than a thousand townships in our State. It may be objected that clerks are unskilled in diagnosticating disease or detecting causes of death. It must not be forgotten that the people of this State began the use of Paris Green knowing it was a deadly poison, and fearing poisonous effects from its use; their attention was directed to this as a probable source of danger, and the fact that from a thousand communities there is not reported a single case of sickness or death suspected to have been caused by eating vegetables to which a known poison had been applied, is very significant. Some persons complain that the potato is rendered watery or waxy by the use of Paris Green, but from my observations I conclude that this waxy condition is caused by the destruction of the leaves by the potato bug, and consequent immaturity of the tuber. I have found this waxy condition in potatoes to which no Paris Green had been applied, but whose leaves were extensively destroyed by the beetle. This immature condition may thus be indirectly produced by the want of Paris Green to protect the leaves of the growing plant.

When Paris Green is applied to wheat during its period of growth, or is present in the soil on which wheat is grown, from having been applied to a previous crop, — will arsenic reappear in the grain and thus injure or destroy its value as food? As wheat is a staple article of human food, this question becomes one of great sanitary importance: wheat is largely exported from the Western States, and as any suspicion of its containing so deadly a poison as arsenic would greatly lower its commercial value, even if it did not exclude it from the market, the question acquires also commercial importance, and should not be settled by mere appeal to general principles, or abstract reasoning of any kind, for there is too much at stake, both for consumer and producer, to permit the possibility of doubt or uncertainty in regard to the answer. The question should be decided by most rigorous and searching experimental tests. In investigating this subject I was not able to secure all the conditions for a complete and satisfactory solution. Thus I was not able to find a field of wheat growing on soil to which Paris Green had been applied last year. To satisfy myself I must gather the wheat myself, and thus be certain that it was the very wheat produced on that given soil. But, for reasons which will appear when I speak of the relation of the soil to arsenical compounds, I became satisfied that Paris Green would exert more influence the first year of its application than it would after it had remained a year in the soil. I therefore turned my attention to this question: *If Paris Green were applied early in the spring to growing wheat and the soil upon which it is growing, — will the ripened grain contain arsenic?* For this purpose I measured off, the last of March, four square rods of a wheat-field, and applied, by means of water and a watering-pot, two ounces of Paris Green, or at the

rate of five pounds to the acre — a quantity greatly in excess of any requirements as an insect poison, but this excess was used for an evident purpose. The Paris Green was thus directly applied to the growing leaves, it trickled down to the roots of the plant, and the surface of the ground was rendered sensibly green by the application. After being thus brought in most intimate relation both with the growing plant and the soil, the poison was left to do its work during the most active period of growth, till harvest time. Thus for more than three months, the Paris Green was in the most favorable condition for absorption by the growing plant. The wheat showed no signs of being injured during its period of growth, but appeared as vigorous and healthy as other portions of the field to which no Paris Green had ever been applied, and the crop ripened perfectly. When fully ripe, I gathered the wheat, threshed it, under such circumstances that it was impossible that other wheat should be mixed with it, and submitted the grain to careful chemical analysis. I weighed out seven thousand grains of this wheat, destroyed the organic matter by the action of chlorate of potash and dilute hydrochloric acid, and subjected the resulting solution to careful examination by Marsh's test, Reinsch's test, and Bettendorff's method, but could not detect the least trace of arsenic by any of these processes. I am fully satisfied that the wheat does not contain the least trace of arsenic, and that it is not injured or destroyed in value as human food, by such dressing of Paris Green.

While the ash of other parts of the plant is found to vary appreciably in composition with varying amounts of mineral food in the soil, yet the composition of the ash of the seed — the most highly developed part of plants — is found to be scarcely at all changed by such conditions. By adding common salt to a soil, we may greatly increase the amount of this material in the ash of the stalks, but without sensibly increasing the amount of either soda or chlorine in the ash of the ripened seed. Even if arsenic should be found in the stalk, we should not expect to find it in the seed. I examined the straw for arsenic, but with negative results.

Will Paris Green become more active by prolonged contact with the soil? From the experiments which I have given, it appears that when Paris Green is applied to potatoes and wheat during the period of growth, arsenic does not reappear in the potato tuber or in the ripened wheat. But the question may still arise, Will this be the result where Paris Green has been for a year or more in the soil? Will it become more active, and be taken up by the growing plant when it has been for a long time in the soil? For this investigation I selected the cabbage, because this was one of the plants which Professor Davy stated to readily take up arsenic from the soil. I took a cabbage which was grown in the College garden, on soil which was planted last year with potatoes, which had received the usual dressing of Paris Green to destroy the potato-beetle. I took six ounces of the cabbage head, destroyed the organic matter with chlorate of potash and acid, and submitted the resulting solution to Marsh's test, but without finding a trace of arsenic. If this quantity of cabbage, when treated for three hours with so delicate a test as Marsh's, would not give the least trace of arsenic, we may

safely conclude that none was present — certainly not enough to injure the health of any one who should use this vegetable for food. From this experiment, I infer that Paris Green does not become more active and assimilable by prolonged contact with the soil.

What becomes of Paris Green in the Soil? The application of so deadly a poison as Paris Green should be considered not alone in regard to its influence on the immediate crop, but also in view of its remote influence on succeeding crops. It is not enough to say that the amount is small, for by repeated applications the amount may become large. However much or little is applied, the material must either be washed out of the soil by the rain, and thus contaminate our wells and fountains, or else it will remain as a permanent constituent of the soil. If arsenic is in the soil, why does it not appear in vegetables and grains raised on such soil, and dissolve in the water percolating through the soil, and become a hidden but terrible source of danger to all who drink such water? It would seem to be a sufficient answer to these important questions to say that Paris Green is insoluble in water. Professor Storer, in his "Dictionary of Chemical Solubilities," under the head of "Arsenite of Copper with Acetate of Copper (Schweinfurt green)," says: "Insoluble in water, but is partially decomposed by continued boiling in water (Ehrmann), soluble in ammonia-water." The terms soluble and insoluble are comparative, and not absolute terms. No salt is absolutely insoluble. I find Paris Green is soluble in rain water containing traces of ammonia, to the extent of one part in 100,000 of rain water. But the water in the soil is charged with carbonic acid, and then has solvent properties greatly superior to pure water. By its means the insoluble carbonates, phosphates, the oxide of iron, etc., are rendered soluble, and thus enabled to enter the roots of plants. I find that water charged with carbonic acid will dissolve Paris Green to the extent of one part in 10,000. It will thus be seen that the statement that Paris Green is insoluble in pure water, does not relieve us of all sense of danger, when we find that exceedingly dilute solutions of ammonia, and water charged with carbonic acid may dissolve sensible qualities, for these are the very conditions in which water is present in the soil under natural conditions. We also find that the fine roots and root-hairs of many plants have a distinctly acid reaction, in consequence of which they have a corroding and disintegrating influence on the rocks. When these fine rootlets come in contact with many kinds of rock, they etch it so as to form on its face a lithograph of their outline, giving the form and position even of the minute root-hairs. Rocks so hard as to resist the knife, are still eaten away by the roots. Even the hard granite yields to their touch. But if the coherent rock is corroded by root-action, much more will the finely-divided soil be acted on. By such root-action even the "insoluble" aceto-arsenite of copper, if present in the soil, may be converted into a soluble form. If we represent the solvent power of this acid condition of the roots as equivalent to dilute acetic acid, we find that water containing five per cent. of acetic acid will in two hours dissolve thirty-two parts of Paris Green in 10,000 of the dilute acid. Thus we find that all the natural agencies by which insoluble mineral matter in the soil is made soluble, and

thus fitted to enter the rounds of plant life, will equally act upon the insoluble Paris Green. Its insolubility, therefore, is not a sufficient guaranty of its harmlessness under agricultural conditions.

Having noticed the natural conditions favorable for its solution, the question arises, Does Paris Green pass into solution in the soil, and remain dissolved in the water in the soil? What are the relations of the soil to solutions of arsenic, and especially of Paris Green? Does the soil itself modify or limit its solubility? "Chemistry has proved," says Professor Johnson, "that the soil is by no means the inert thing it appears to be. It is not a passive jumble of rock-dust, out of which air and water extract the food of vegetation. It is not simply a stage on which the plant performs the drama of growth. It is, on the contrary, in itself the theatre of ceaseless activities; the seat of perpetual and complicated changes."[1] It is the scene of chemical activities and forces of a pronounced order. The ordinary laws of solubility are modified or even reversed by its action. It has long been known that the soil has the power of withdrawing from solution and fixing in a form insoluble in water, many substances distinguished for their ready solubility in water. Thus, a solution of the salts of potash or ammonia, when filtered through a fertile soil, yields up to the soil a sensible quantity of these bases, which cannot be completely washed out of the soil by pure water. This action of the soil on substances of the highest value in agriculture is intimately connected with the preservation of fertility. Without this power, the practice of under-draining would be most disastrous to soil fertility, leaching out and washing away the substances soluble in pure water, and speedily reducing the most fertile soil to a barren waste. Our soils would be as effectually leached as ever the soap-boiler leaches ashes. But the soil has a wonderful power of "taking care of itself," selecting and fixing in an insoluble form the substances needed to maintain its fertility. The question arises, Is this absorptive power of the soil limited to substances which contribute to, and are essential for, its fertility, or does the soil have a like power over substances which are injurious to the plant and would be inimical to human life if they reappeared in the food? The forces which produce soil-absorption are partly physical, and partly chemical, but the chemical forces appear to be most active. If we fix our attention upon the chemical forces existing in the soil, we find strong antecedent probabilities that soil absorption will be energetic in regard to arsenious acid, and its salts. All fertile soils contain sensible quantities of lime, magnesia, and hydrated oxide of iron. Lime water is a recognized precipitant of arsenious acid. Hydrated oxide of iron is still the standard antidote for arsenic, because of its well known power of forming an insoluble salt with arsenious acid. Fertile soils contain from one to five per cent. of hydrated oxide of iron. This substance, as an antidote, is not as efficient where it has been prepared a long time, and I concede that the oxide of iron in the soil may be still less efficient, but whatever its age, the hydrated oxide of iron has a marked power of converting arsenious acid into a form in which it is soluble only in the strong mineral acids. When we consider the absolute

[1] *How Crops Feed*, p. 331.

amount of this substance present in every fertile soil, we see that its influence must be most significant. If we take the minimum quantity and estimate the weight of an acre of soil taken to the depth of one foot at 1,000 tons, the one per cent. signifies the presence of 20,000 pounds of this oxide of iron in each acre of soil! Shall we suppose that this large amount, present in every part of the soil, will be without influence on arsenious acid and its salts even if they are applied in solution to the soil, or become dissolved in the water of the soil? Not wishing to leave so important a question to be settled by general principles or abstract reasoning, I submitted the matter to a practical test. I placed six pounds of perfectly dry garden soil in a large glass funnel, and filtered through this soil a solution of arsenious trioxide containing exactly one part in one thousand of water. I filtered off one litre, which would contain one gram of the arsenic, if none were taken up by the soil. I tested this by passing through the acidulated solution a stream of sulphureted hydrogen for three hours. Only a very slight precipitate of sulphide of arsenic was obtained. I then filtered another litre of the arsenical solution through the same soil, and treated this filtrate in the same way, and obtained a somewhat abundant precipitate, but far less than I obtained from a like quantity of the original solution. This soil had become partially saturated by the first litre of the solution, but not fully, because it still took up a large part of the arsenic from the second litre. Here we see that this small quantity of soil had taken up from solution and fixed in insoluble form a comparatively large amount of arsenious acid, but that it has not an unlimited power of fixing this substance.

Soil action on solution of Paris Green. I then endeavored to ascertain what would be the action of the soil on a solution of Paris Green. I dissolved two grams of Paris Green in hydrochloric acid, and slowly filtered this through five pounds of dry earth especially rich in lime, and obtained half a litre of filtrate. Neither by sulphureted hydrogen, nor by Reinsch's test, could I detect a trace of arsenic in this filtrate. The soil had withdrawn from solution both the arsenic and the copper. The question now arises, What becomes of Paris Green in the soil? Does it remain in the form of aceto-arsenite of copper? Or is it changed into some other form of combination? Is it washed out of the soil? I have already stated that I applied Paris Green to a wheat plot early last spring at the rate of five pounds to the acre. After the wheat was harvested, I collected a quantity of the surface soil, to determine the presence or absence of the poison, and the state of combination after several months' contact with the soil. I placed eight ounces of the dry soil in each of five bottles, and subjected this soil to the action of several agents which would represent the action of the several natural solvents acting upon it under agricultural conditions. To one I added a pint of rain water; to the second, a pint of rain water saturated with carbonic acid; to the third, a pint of rain water containing ten per cent. of ammonia (to represent in an exaggerated degree the action of rain water containing ammonia derived from the air); to the fourth, a pint of rain water containing five per cent. of acetic acid (to represent the solvent power of root action

in soils); and to the fifth, a pint of water containing five per cent. of sulphuric acid (to determine whether arsenic was present in a form soluble in mineral acids). These bottles were corked up securely, and their contents shaken up daily for two weeks. The solutions were then filtered off, the filtrate evaporated to a small bulk, and carefully tested for arsenic by Marsh's test. Not the least trace of arsenic was obtained from the first, second, third, or fourth bottles, but a very distinct deposit of arsenic was obtained from the fifth. From these experiments it appears: —

1st. That Paris Green, after remaining in the soil more than three months, did not then exist as the aceto-arsenite of copper, but had passed into some less soluble form, for otherwise the filtrates from the second, third, and fourth bottles should have given distinct reactions for arsenic.

2d. The material had not washed out of the soil, because dilute sulphuric acid dissolved it from the soil in sensible quantities. The apprehension that the water supply will be injured by Paris Green passing into solution, appears to be entirely groundless.

3d. The arsenic comported itself, so far as solubility is concerned, as it would if it existed in the form of the basic arsenite of iron; namely, insoluble in water and in acetic acid, soluble in sulphuric acid.

Conclusions. In these examinations I have satisfied myself of the truth of the following propositions: —

I. Paris Green being a deadly poison, should be handled with extreme care. By inhalation of the dust, by contact of the material with sores or raw surfaces, and even with a moist and perspiring surface, it may produce dangerous effects.

II. While classed as an insoluble substance, Paris Green becomes soluble to a sensible degree by the action of what we may call the natural agricultural solvents. Carbonic acid, and the solvent action of the minute roots of plants, may be regarded as the most active of these agricultural solvents.

III. Solutions of arsenious acid and of arsenites tend to pass into an insoluble condition in the soil, in which arsenic is insoluble by the natural agricultural solvents.

IV. While other agents may assist in fixing arsenious acid in the soil, the hydrated oxide of iron is probably the most potent factor in producing this insoluble condition; that enough of this oxide is present in all fertile soils to render inert a comparatively large amount of arsenic; and that it is to this agent that we owe our safety when Paris Green is applied to the soil. When Paris Green is applied to the soil in such quantity that the hydrated oxide of iron present in such soil is not sufficient to speedily change it to the inert condition, we should expect this agent would injure the health, or even destroy the life of the plant. The limit of safety would naturally vary with the varying composition of soils. Mr. McMurtrie places the limit in one instance at 900 lbs. to the acre — a quantity vastly in excess of any requirements as an insect poison.

V. Paris Green, mixed with the soil, does not remain in the form of aceto-arsenite of copper, but the arsenic is probably converted into the basic arsenite of iron.

VI. Paris Green, when applied in small quantity, does not seem to affect the health of the potato, or wheat plant; the arsenic which it contains does not reappear in the tuber of the potato or the grain of wheat, and that these substances are not injured as human food by the small quantity of Paris Green which is required to free our fields from a most destructive insect.

VII. Paris Green does not pass from an inert into an active form by prolonged contact with the soil.

VIII. The power of the soil to remove from solution and hold in an insoluble form, arsenious acid and arsenites, will protect the water supply from deadly contamination by this agent, unless this poison is used in excess of any actual requirements as an insect destroyer.

THE INFLUENCE OF CITY LIFE AND OCCUPATIONS IN DEVELOPING PULMONARY CONSUMPTION.

By Professor F. Donaldson, M. D., *University of Maryland, Baltimore.*

A DISCOURSE BEFORE THE ASSOCIATION AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 10, 1875.

Notwithstanding the advances that have been made within the past few years in Hygienic Medicine, but little has been written and still less done in regard to the prevention of Pulmonary Consumption, — the great scourge of the human race.

What are the influences which develop this disease, especially in the cities where the mortality from it is very great, certainly is a most legitimate inquiry for a Public Health Association to make.

The popular belief of the comparatively greater healthfulness of the country over that of the cities is amply confirmed by vital statistics. By referring to them, we find that in Amsterdam, there are 171 deaths to every 100 births; in Berlin, 131 deaths to every 100 births; in London, the proportion is 124.92 deaths to every 100 births! In London, annually, the deaths exceed the births by 10,000. "This difference," says Dr. Hough, in his elaborate paper before this Association, in 1873, "would be much greater were it not for the hundreds of thousands of strangers who annually take up their residence in the great metropolis. If this supply of sturdy strangers were cut off, London would rapidly decline in population; indeed, this might be said, with equal truth, of any large city. None of them could keep up their population without recruits from the outside. The human race would become extinct in one or two centuries if we all lived in large cities." The mortality of great cities is found to be two and a half times larger than that of the rural districts.

Pulmonary Consumption claims a large percentage of this mortality — it is, in England, certainly 25 per cent. greater in cities than in the country. Our very luxuries and comforts in cities contribute, in no small degree, to the development of phthisis.

It is estimated, says Dr. Benjamin W. Richardson, that in the temperate zone, within which nearly all the civilized inhabitants of the globe are located, one tenth, at least, of the population, die of consumption.

In New York, the percentage of deaths from consumption is 14.09 of the whole mortality. In Boston, 15.17. In Philadelphia, 14.28. In Baltimore, 14.55. In the whole State of Massachusetts, it is 20 per cent. Dr. Holmes said a few years ago, in an address at Harvard, that every other adult met in the streets of Boston had or would have some form of tubercular disease. The hygienic and climatic treatment of consumption, after it has been devel-

oped, is acknowledged to be the best means of arresting its progress. To detect the influences that promote the development, so as to be enabled to prevent deposits, to eradicate the tendencies, and to ward off heredity, is infinitely more worthy of our attention and our exertions. To encourage us to work for this end, let us examine as to what has already been done, and we will find that it has been productive of decidedly good results.

To Dr. Bowditch, of Boston, is due the credit of the discovery of the relation between dampness of soil and phthisis as one of cause and effect. Dr. Buchanan, of England, although ignorant of Dr. Bowditch's views, reported the same conclusions to the Privy Council. The correctness of these opinions have been sustained, by proof, in several towns where the subsoil had been dried, either by construction of drain-sewers or by special drains and deep stone culverts; and the mortality from consumption had been reduced nearly 50 per cent. In Salisbury, for example, the death rates from phthisis had fallen 49 per cent.; in Ely, 47 per cent.; in Rugby, 43 per cent.; in Banbury, 41 per cent. In other towns, where no drying of the subsoil had been effected, there was no reduction in the phthisis death-rate, although great care had been taken to remove the filth!

Ought we not to hold in grateful remembrance our earnest co-workers, Dr. Bowditch and Dr. Buchanan? To have established facts having such a bearing upon the saving of human life, is honor enough for any man's short period of existence. Jenner's discovery keeps small-pox within control, but consumption is doing its deadly work at all times and nearly all places. It is not confined to any portion of the globe, nor does it appear in epidemics. It is met with in all latitudes, from the mean temperature of the equator of 80° with slight variations to the higher portions of the temperate zone, where the mean temperature is 40°, with sudden violent changes. It is more prevalent in tropical than in temperate countries. It is rarely found in Iceland, in Siberia, the Faroe Islands, the Orkney, Shetland, and Hebrides. It is most prevalent at the level of the sea, and seems to decrease with increase of elevation, according to Fuch, Von Tschudi, and Mackey. At Marseilles, on the seaboard, the mortality from that cause was 25 per cent.; at Hamburg, 48 feet above the sea, it is 23 per cent.; while at Eschwege, 496 feet above the sea, it is only 12 per cent.; at Brotterdode, 1800 feet above the sea, the mortality is reduced to 0.9 per cent. Dr. Gleitsman has published a number of interesting facts in regard to the immunity from consumption in very high localities. Such as on the Andes of Peru, tablelands of the Rocky Mountains, in the towns of Santa Fe de Bogota at an elevation of 8,100 feet, Potosi, about 12,000, and the Puna region of the Peruvian Andes, at 11,000. In Europe, many places on the Alps, as in Styria, Carniola; on the western section of the Pyrenees. In Africa, immunity is said to exist on the plateaus of Abyssinia. In Mexico, at 8,000 feet above the level of the sea, it is but rarely met with. In Asia, on the high plateaus of Armenia and Persia.

ALTITUDE.

These facts have caused the establishments of climatic sanitaria, which make very favorable reports as to the effect of the atmosphere of the high

mountains upon cases of consumption. From Dr. Brehmer's Institute in Silicia, Prussia, we have a report from 1854 to 1869, where 958 consumptive patients were treated. Of these, 315 were already in the colliquative stage of the disease. Of the whole number 958, only 47 died, or 4⅘ per cent., and 20 per cent. were permanently cured, and during the comparatively short treatment of 86 days. Davos, in Switzerland, reports also astonishing results. Dr. Gleitsman has recently established, with encouraging prospects of success, a mountain sanitarium at Asheville, North Carolina, which is 2,250 feet above the level of the sea. From these facts, altitude appears to be an influential climatic element to prevent the development of phthisis. On the other hand, Blodget, in his work on the "Climatology of the United States," states that this view is not confirmed in this country, for all diseases of the respiratory organs increase as the temperature decreases, with like conditions of humidity; and increase still more directly with the greater variableness of the climate. Great variations of temperature and humidity in a climate generally cool and damp, afford conditions extremely favorable to development of consumption. It is undoubtedly true that a mild, equable, elastic climate, generates very little of disease of the respiratory organs. Over the whole interior and Pacific region consumption is but rarely met with. In Southern California the climate is as good as that of any part of Italy. Of admissions, says Dr. Hatch, to the City Hospital, San Francisco, for nearly two years, — 1851 and 1852, — there were 84 respiratory diseases in a total of 1870, — of these, 11 were of consumption, — 45 per thousand of all, and 5.8 per thousand of consumption! The large cities in this country and in Europe, are generally located upon the sea-coast, or the lakes and navigable rivers, many of them on marshy flats, some of them between two rivers. How few of them have mild and equable climates, so favorable to the vigor of the respiratory organs. — Dr. Toner's Dictionary of Elevations gives us the information. New York, with its population in 1870 of 942.292, is 35 feet only above the level of the sea; Philadelphia is also 35 feet above the level of the sea; Boston, 40; and Baltimore, 60 feet. Their climates are not such as affect favorably respiratory diseases. We have shown this by statistical facts.

Thus we see that the very situation of large cities is a powerful influence in developing pulmonary consumption.

PATHOLOGY OF CONSUMPTION.

In order to appreciate the influences which develop pulmonary consumption, we must glance, although hurriedly, at its pathology. Careful researches within the past twelve years, conducted by competent English and Continental observers, have materially changed the views formerly held. Laenrec, the master-mind of his day in regard to diseases of the lungs, had left such an impress upon medical thought that his opinions of their pathology had been almost universally accepted. He maintained that all cases of consumption were tubercular in their nature and were of a constitutional origin, and that the disease never resulted from previous local diseases. He

taught that whenever at *post mortem* examinations lesions, such as infiltrations of the lungs, caseous masses, or evidences of bronchitis were found, that they were necessarily secondary to tubercle itself, and caused by the irritation of its presence.

Tubercle was considered a deposit heterologous in its nature, and one that could be transmitted from parents to their children. All cases of hæmoptysis were pneumorhagias, and had been preceded by tubercle. The degenerations of a caseous nature, so frequently met with, were all supposed to result from the metamorphosis of tubercular formations.

Thanks to the pathological investigations of Virchow, it was satisfactorily proved that other deposits and formations, such as are met with in lymphatic glands, unabsorbed spots of pneumonia, coagula of blood, and, indeed, any hyperplastic growth, could undergo caseous transformations. It was shown, moreover, that frequently the bronchioles and condensed alveoli, with small masses of caseous substances, were frequently confounded with tubercle. Thus, that persons would die of consumption without a single tubercle being found in the lung tissue or its connections, and that caseous matter would even break down and large cavities form, and yet without there being any tubercle. Here was a great change in the current views of pathology.

Without taking up the time of this Association to trace the progress of the change of views caused by microscopical and chemical investigations, it is only necessary to state that *what is popularly designated as pulmonary consumption is not one specific disease, but several diseases, resulting from different morbid conditions.* One prominent fact must be dwelt upon, and that is that a very large proportion of the cases met with are inflammatory in their origin, and are caused by catarrhal, croupal, and chronic pneumonia—the lymphoid deposit resulting from these diseases, with the alveoli breaking down into caseous material. The disputed points between Ruhl and Rindfleisch contending that some of them are interstitial, is to us of small moment. *The products of any inflammatory disease in the lungs may by degeneration become consumption.* How readily this explains the cases resulting from trades and occupations giving rise to a dusty or gritty atmosphere—small particles of coal, cotton, flint, flax, steel, or hair in factories taken into lungs by inhalation, and frequently detected in them chemically and microscopically after death, actually, by their mechanical presence, causing phthisis. Dr. Greenhow calculated that 45,000 deaths occurred from this cause in England, and that the whole of this mortality might be prevented by the introduction of better methods of working and of ventilation. Since Greenhow's reports were made, Acts of Parliament have been passed which, if carried out, would totally abolish this cause of phthisis. Moreover, Niemeyer's views in regard to clots in cases of bronchoragia collecting in the air-sacks causing phthisis, are, in all probability, correct. These act as foreign substances, and produce irritation, and then inflammatory disturbances of nutrition, throwing out a product rich in indifferent cells. Caseous metamorphosis almost necessarily follows. Is it not also likely that masses of mucous becoming lodged in the minute bronchi can produce the same re-

sults? Moreover all other diseases of the respiratory organs, by altering the normal position and functions of the texture, cause a state of mal-nutrition which frequently ends in a lobular deposit. Emphysema, or dilatation of some air-cells press upon others and impair respiratory force. Subacute and chronic pleurisies, by mechanical pressure, produce consolidation of lungs. Formerly it was considered that when consumption appeared to follow these diseases it had in fact preceded them.

There are cases where we have a product known as milliary tubercles. They, too, are the result of mal-nutrition. Their histological construction is the same as that of the caseous deposits — a great accumulation of lymphoid cells and granules with giant cells. Rindfleisch maintains this view, and also that they are produced by chemical alterations of the protoplasms and the nuclei of the cells. Dr. Sanderson states that tubercles and consolidations, artificially produced, consist essentially of overgrowth and induration of the adenoid tissue naturally existing in the various textures. They are not specific bodies ; they have been produced artificially in animals by injection into the circulation of tubercular matter, by Villemin in the first place, and afterwards by Lebert, Cohnheim, Waldenburg, Klein, Burden Sanderson, Wilson Fox, and by the injection not only of tubercular matter, but of caseous matter, pus, blood, and in numerous instances of vegetable products, cotton, cork, coal, blotting paper, and pieces of gutta-percha. Rabbits and guinea pigs, over and over again, have been made tubercular by the introduction into their blood of these foreign substances and vegetable fabrics.

How completely do these facts overturn preconceived notions. The importance of these modern views of the pathology is very great to us in discussing the influences which produce consumption. *We must bear in mind that it is a disease intensely inflammatory in its origin ; and even when tubercular it is not a specific disease, but one resulting from mal-nutrition.* We hope to show that such being its nature its prevention can, in a great measure, be accomplished by sanitary and hygienic observances.

Heredity. Hereditary predisposition is unquestionably a prominent general cause of phthisis pulmonalis.[1] What is the exact influence which is

[1] Before modern researches had shown the pathology of phthisis this cause was regarded as the all-important one. The fuller recognition, however, of such general causes as mal-hygienic and climatic influences has materially lessened the value of former opinions on this point. To a still greater degree has the effects of the local causes, such as pneumonias, bronchitis, pleurises, and inhalation of mechanical impurities, modified the prevalent views. All biologists have, however, acknowledged the influence of heredity. Medical public opinion is very unanimous in regard to it. Of the 210 physicians interrogated by the State Board of Health of Massachusetts, only one denied that consumption was caused or promoted by hereditary influences. What do vital statistics, carefully collected, prove in regard to heredity in this disease? Of the 1010 cases treated in the Brompton Hospital, 24.4 per cent. inherited the disease from their parents. Of Dr. Fuller's 385 cases, 59 per cent. had had either parents, grandparents, uncles or aunts, who had died of consumption. Dr. Cotten's 1000 cases, including parents, brothers, and sisters' history in the investigation, gave 36.7 per cent. Dr. Pollock's 1200 cases, similarly estimated, showed 30 per cent. Dr. Theodore K. Williams, in tabulating his 1000 cases, draws a distinction between the purely hereditary cases, that is, as coming from the parents alone, and

transmitted? Microscopical and chemical analyses of tubercle itself show it does not differ from the products of inflammation. We must bear in mind that parents who have not themselves consumption can have consumptive children. The children of syphilitic or gouty parents, of aged parents, and of those whose constitutions have been weakened by excesses of various kinds, or other debilitating causes, are prone to phthisis.

That which is inherited is not the disease itself, but the weakness or vulnerability of constitution, which had laid the foundation for the pulmonary disease in the parents, or had been developed in them as a result of other diseases. As Niemeyer says, it is more correct to state that the child is born with such a disposition than to speak of its inheriting it. As we can take a plant out of the light and heat, and subject it to darkness and cold, and thus prevent growth and fructification, so can we foster a vulnerability, or we can remove it by the means nature has given us. We know that an individual by his life and habits can *acquire* a predisposition; by weakening his power of resistance to the exciting causes of phthisis, he can fall a victim to it. Dr. Williams states that when, in addition to the predisposition of parents, he examined into that coming from grandparents, uncles, and aunts, he found the percentage as high as forty eight. The hereditary influence of the mother is far greater than that of the father, because his influence is exercised at conception only, whereas that of the mother at that period and all through uterine gestation and lactation. Family predisposition is much more commonly met with among women than among men, the proportion being fifty-seven per cent. of women to forty-three per cent. of men. In hereditary predisposition the proportion is greater still in favor of men, nearly two to one. Dr. Williams' tables show that in hereditary males the development of phthisis is earlier, average age 24.64 years, whereas in those free from taint the average age of the attack is thirty-two years.

As children resemble their parents in their color, in their features, in their dispositions, and even in their manners, so do they derive from them that predisposition which render them liable to the development of phthisis. The primary weakness is in the formative forces which can be strengthened or weakened by the conditions and circumstances in which the parties are placed. This hereditary tendency can be materially lessened, and even entirely corrected, by supplying the necessary elements of nutrition and placing the individuals in good hygienic surroundings. Consumptive ancestry is an influence which ought to be recognized, in order that it may be combated by the strict observance of what Dr. Black appropriately designates the ten laws of health. Pure air, good food, out-door exercise, warm

the cases of family predisposition, which would include grandparents, aunts, and uncles. The purely hereditary, *i. e.*, from parents, was only 12 per cent. — differing very widely from the percentages of Drs. Cotten and Fuller, and of the Brompton Hospital. Dr. Williams accounts for this difference by stating that his percentage was derived from cases in private practice, where the parties were enabled to keep off from some of the most fertile causes of phthisis. This is what we would have a right to suppose from the acknowledged greater frequency of consumption among the poor. According to D'Espié there are sixty-eight deaths per thousand of the whole mortality among the rich, to two hundred and twenty-three per thousand among the poor!

clothing, sunlight, regular habits, etc., will strengthen the organism and eradicate the hereditary taint. As Dr. C. J. B. Williams has expressed it, pulmonary consumption arises from a deficiency of vitality in the natural bioplasm which undergrows degradation in a sluggish, low-lived, yet proliferating matter, which, instead of maintaining the nutrition and integrity of the tissues, clogs them and irritates them with a substance which is more or less prone to decay, and eventually involves them in its own disintegration and destruction. This degraded bioplasm he designates as phthinoplasm, or wasting forming material. We can in many cases cure a predisposition to phthisis, and we can originate it by personal opposite courses. *The exciting causes, we believe, are more powerful in developing pulmonary consumption than hereditary predisposition. They moreover are more active in cities than in the country.*

Acquired Predisposition. There is moreover a predisposition which is acquired, where the individual, by his life and habits, weakens his power of resistance to the exciting causes of phthisis. Cities tempt to excesses of all kinds, immoral, alcoholic; to exposure, late hours, and other depressing causes; loss of rest, anxieties of speculative business. These frequently are as strong in giving a predisposition as that derived from parents.

Impure Air. Of all influences in developing consumption in cities impurities of the air are acknowledged as the most prominent. It is because the oxygen of the air and of the food are the factors of the chemical changes of the organism. It is through these changes that we find the manifestations of life, such as heat-production, muscular contraction, nutritive, formative, and assimilative action. Life implies change, and its activity is in proportion to change, and for this, oxidation is essential for the development of force. The normal proportions of oxygen in the atmosphere are necessary for these purposes. The true process of respiration has only been well understood for the past fifty years. That which takes place within the chest is only the commencement of the interchange of gases which is the essence of respiration. It extends to the minute histological elements of the body, and air that is deprived of its normal proportion (20.99) of oxygen, or is loaded with extraneous substances, affects profoundly nutrition, and impairs the strength and intrinsic vigor of the organism.

Professor Wilson states that the quantity of oxygen is always sensibly diminished in the air of large cities even in the open street. The lungs are the most sensitive parts of the organism to the impurities in the atmosphere, whether they be gaseous or suspended matters. They come into immediate contact with the delicate structure of the lungs and materially affect their functions and injure their nutrition. The demonstrations of Professor Tyndall with the electric light astonished the scientific world, and showed the almost universal diffusion of suspended materials in the atmosphere. Every chemical constituent of the soil is lifted and carried by the winds broadcast. The vegetable world contributes seed and the debris of vegetation, as well as volatile matter, spores, and germs. The animals throw off decayed and decaying organic matter, epithelium, pus, besides germs of vibrious monads and bacteriæ.

I must merely allude to those vitiations of the air which are especially deleterious to health, and which have been proved to be so in developing pulmonary consumption. Human beings by consuming such quantities of air every hour deprive it of its oxygen and communicate to it effete substances in the form of carbonic acid, organic matter, vapor, and ammonia. The oxygen absorbed is equal to about five per cent. of the volume of air respired, and the carbonic acid exhaled, about four per cent. Dr. Parkes gives the average amount of carbonic acid exhaled by an adult in the twenty-four hours as sixteen cubic feet. The quantity of water given off by the lungs in twenty-four hours varies from twenty-four to forty ounces. The organic matter thrown off has not been very accurately ascertained. It has a very fœtid smell, and is very slowly oxidized. "It is believed," says Wilson, "to be molecular, and may be said to hang about a room like clouds of tobacco smoke, and the odor is difficult to get rid of even after free ventilation. It darkens sulphuric acid, and decolorizes a solution of permanganate of potash. When drawn through pure water it renders it very offensive. It is certainly nitrogenous in its nature. In sick rooms it is associated with pus cells, and other emanations of disease. As much as forty-six per cent. of organic matter was found in plaster taken from the walls of a hospital ward in Paris. The carbonic acid varies from .03 to .05 per cent. in pure air. According to Dr. Parkes, the quantity of organic matter increases with carbonic acid, and when it reaches seven per one thousand cubic feet of air it is perceptible to the smell.[1] The poisonous effects of carbonic acid, when in large quantities, is familiar to all, as demonstrated in the case of the 146 prisoners in the "Black Hole" of Calcutta, of whom 123 died in a single night; and also in the case of the 150 passengers shut up in the Irish steamer *Londonderry*, of whom 70 died before morning. After carbonic acid reaches 1.5 per 1000 volumes it produces headache and vertigo.

The English army sanitary commissions report published in 1858, show that the excessive mortality from consumption amongst soldiers, and in particular regiments, was due to insufficient ventilation and contracted quarters. The air in the barracks of the Foot Guards only amounted to 331 cubic feet for each soldier, and the mortality from phthisis was as high as 13.8 per 1000. In those of the Horse Guards, on the other hand, with a space per man of 572 cubic feet, the mortality from phthisis did not exceed 7.3 per 1000. After the report was made the number of cubic feet was increased, and the ventilation improved, then the number of phthisical

[1] Dr. Parkes states that, allowing four volumes as the average amount of carbonic acid in one thousand volumes of air, the standard of permissible maximum impurity ought not to exceed six per one thousand volumes, because beyond this the organic impurities become imperceptible to the senses. Assuming Dr. Parkes' estimate to be correct, the amount of air that should be supplied to each individual per hour is three thousand feet cubic. How far this estimate is beyond what is supplied in the largest and best ventilated private houses in cities is familiar to all. That numerous diseases are directly caused by re-breathed air, which has become poisonous and stagnant from want of ventilation, is now well recognized, as is also the fact that phthisis pulmonalis holds a prominent place on the list. Dr. McCormic, in his work on phthisis, gives numerous instances of sad effects from impure air in overcrowded houses.

cases occurring was materially diminished (Wilson). The crowding of people into narrow quarters among the poor is an institution of cities, and causes yearly many thousand deaths.

With the poor, they not only breathe their breaths over and over again, but the oxygen of their quarters is rapidly destroyed by their sheet-iron stoves. The organic matter and smoke from the cooking and burning of coal gas are fearfully destructive of air. A one-foot burner destroys the oxygen of eight cubic feet of air in combustion, and produces two cubic feet of carbonic acid, besides other impurities, in one hour. The air of a room of 420 cubic feet ought to be renewed eight times per hour, in order to keep the air fit for respiration ; but this is, unless by powerful artificial means, an impossibility. It is notorious, even among the rich, who can have large houses and capacious rooms, that the air is not kept sufficiently pure. They fear draughts so much that they keep themselves and their children breathing air which undermines their physical frame slowly, though not the less surely all the time. Even if they allow the standard space of 1000 cubic feet per head, they do not permit the air to be changed especially by cross ventilation — the surest way.

I do not wish to occupy the time of the Association in discussing the general necessity of ventilation, but the subject-matter demands that I should insist upon it as a means of averting pulmonary consumption. Go where we will, practitioners visiting from house to house, we find impure air. Our very places of worship are often oppressive from want of ventilation, and our theatres and concert halls habitually so. Windows which ought always to be kept open in unoccupied rooms are habitually closed!

Persons predisposed to consumption, or who have a delicacy about the organs of respiration, should not, if possible, be allowed to live in large cities where the air is so impure, but should be given out-door occupation in the country, where even in-doors the open fire-places and the penetrating winds force the impure air out and pure air into the house.

We claim that musty houses are not only unhealthy but positively poisonous. The organic matter collects in quantities in them and saturates the air ; the venous blood is only partially arterialized, and consequently the nutritive functions are so lowered that inflammatory processes and tubercles occur readily in the lungs. It is thus not difficult to explain why neglect of ventilation is such a fruitful source of consumption. Rebreathed air contains carbonic acid in excess and a deficiency of oxygen. Blood cannot take up easily the oxygen, nor get rid readily of the carbonic acid, because the conditions of the exchange gases are absent. It does not at once suffocate, but it lowers all the organic processes of the body. Persons living in such an atmosphere think they are not being poisoned because it is slow in acting. The depression of the forces of life interfere with the strength of the formed tissues, and Consumption is the result. *If we could only convince the community of the fact that vitiated air was so frequently a cause of consumption, it might supply a motive which would induce them to attend to the all-important requirements of ventilation.*

The human organism will not with impunity allow any alteration of the

quantity or quality of the atmospheric air. It is useless for physicians to object to tight lacing, yet by its interference with the due supply of air it promotes directly the development of pulmonary consumption. Herbsis' experiment ought to convince the sex of its injurious effects. The same man, who when unincumbered by clothing, inspired 190 cubic inches at a breath, could only inspire 130 cubic inches when dressed. How much greater must be the difference when women's stays allow such little expansion of the chest!

Deficient sunlight. An influence of ill-health which is felt more especially in cities is the absence of sunlight. Many houses are situated due north and south, and the sun never reaches their front. The neighbors' residences or their own outbuildings keep off the rays from the other sides. Where the sunlight does attempt to intrude through the windows it meets with a persistent effort on the part of the mistress of the establishment to exclude it by means of inside curtains or outside shutters. The careful housewife wishes to protect the bright figures so beautifully woven in her carpets. It is no exaggeration to state that in many of the streets, not only of the older cities such as Rome and Paris, but of our own towns, the streets are so narrow and the houses so high that the sun never reaches either the sleeping or the sitting rooms. Again, a number of the modern houses of the rich are built three rooms deep in order to have the parlors and dining-room on one floor, and on each story above three sleeping rooms. A very convenient arrangement this for ease, but not for health. The middle room is necessarily a dark one. The parents consider this a nice arrangement for their children to be near them in case of sickness, but it never occurs to them that a room so far removed from the sun's rays is an unhealthy place in which to put their children. They certainly would not put their flowers there unless they wanted to bleach them. It is not only from the residences that we have the beneficent orb's influence so sedulously excluded, but the school-houses are so situated that the children can scarcely even see the sun's rays, unless it is to teach them some fact of science in connection with it. In our places of business and warehouses we find the same disregard of the simplest hygienic knowledge of the value of sunlight. Many mercantile firms transact their business in narrow streets in the older parts of our cities where the sunlight is never seen, unless probably for a short time at noon and then only in the middle of the street. It cannot get into the lower floors, or indeed anywhere where active business transactions are conducted. Even if the streets are wide the business floors are so many feet long that the sun can only enter a few feet. Ground space is so valuable in the thronged streets that every spot, where it is possible to put a building, is built upon, and every part of this made to yield a revenue. We have in the business portions of our cities underground rooms, five, ten, and sometimes twenty feet below the surface, in which frequently not only goods are stored but clerks are at work at their desks. In these, as far as the light of heaven is concerned, it is perpetual darkness.[1]

[1] There is light there but not the light that nature intended they should have. The gas-

If a leafy shoot of any plant be bent down without injury, so as to reverse the usual position of the forces of the leaves, the latter will twist upon their petioles and turn their upper surfaces to the light. Shoots of jasmine and amfelopsia, when trained in a dark room, will twist around to face the light. *Thus the plants show a higher appreciation of sunlight than the better half of the highest in the scale of animals.*

What is this sunlight which is intentionally or thoughtlessly kept out of our houses and off of our persons? It is nothing more nor less than the source of all force and consequently of all life, animal and vegetable. It was so made by the Creator, when He said, "'Let there be light,' and there was light." In the eloquent words of Sir David Brewster, "Light is the very life-blood of Nature, without which, everything in nature would fade and perish utterly."

It is unnecessary to recite all the facts in nature that have established our belief, that the various forms of force, manifested in the actions of animal life, trace their origin to that emitted by the sun, and that plants are the media for fixing the solar force for converting actual into latent or potential energy. Light influences the chemical changes made through food and air. Molecular rest is prevented in living beings by sunlight, and molecular activity constitutes life. Every one admits the necessity of a full exposure to the light of day to insure vigorous and healthy growth in almost all plants, the leaves and flowers of which follow the direction of the sun throughout its whole course from east to west. Sunlight is as necessary for the color of animals as plants, and for the preservation of health and the attainment of the full development of the animal frame. Without light, the mother coloring principle of the organism, the hæmoglobuline, is rendered pale, and the

light enables the clerks to write and keep their accounts, but at a fearful expense, not to the proprietors, but to the clerks themselves. The health of their bodies suffers more than if they were in darkness, for, in addition to the absence of the sun's healthful influence, they are compelled to breathe an atmosphere which is almost stagnant, rendered impure by their own breaths, and what is worse still, by the very means used for illumination. How long can the air remain pure when there are several persons, each consuming sixty gallons an hour, and a number of gas jets, each of which destroys air as much as eleven men, 660 gallons per hour. But this is not all: in winter, when the windows must be closed to keep out the dampness of the surrounding ground, stoves are frequently used to keep the underground quarters comfortable. It is estimated that an ordinary stove will consume 15,000 gallons of air per hour! These basement rooms are considered very desirable for business purposes, and bring in high rents. They are much sought after for banking establishments, and singularly enough for Life Insurance Companies, who do not hesitate, in insuring the lives of outsiders, to take the lives of their clerks and employees. Thus it is that not only in the principal cities of Europe, even in Italy, "where Nature wears her brightest attire," hundreds of thousands of persons carry on their trades in almost utter darkness, but also in the cities of this progressing country of the new world. The sunlight is considered an enemy by the fair sex, who appear to be continually on their guard lest it should reach their faces. They avail themselves of all sorts of material to put over their pretty features to protect them from the sunlight; they consider the ruddy color of health unbecoming, and they think that a woman is more ladylike when her skin is transparent and bloodless. If their medical adviser undertakes to expostulate with them, he will find that he has undertaken a thankless office, and he may even be so treated as to discover that the sex is not always properly called the *gentle sex.*

lessened intensity of the beautiful scarlet color is observable to all. Now the intensity of the red color of the red globules has been demonstrated to be owing to the quantity of oxygen they contain, and they have great avidity for ogygen and absorb it readily whenever they come in contact with it. The nutritive functions of the body depend upon this oxygen. Is it astonishing, then, that children and clerks shut out from the light, and workmen in tailor shops, millinery garrets, and mines should be pallid and ghastly, their muscles soft and flabby, and their nervous system relaxed and irritable?

We must bear in mind the effect of sunlight in dissipating dampness and preventing musty smells which are so promotive of disease. There is no surer way of developing a predisposition to consumption, or if there should be no hereditary tendency, of actually creating this disease. Constitutions thus trifled with have no power to resist the causes which bring about inflammation and mal-nutritive results. Our daily experience demonstrates the justice of this conclusion. In the country it is almost impossible to exclude the sunlight, and the occupations of those who live in the rural districts are not such as shut them out from the light. *Are we not right in considering absence of sunlight as having a powerful influence in developing pulmonary consumption?*

Sedentary Life. Many of the city occupations involve necessarily a sedentary life. This is in violation of the laws of health, which require of necessity more or less of active muscular exercise. The physiological death of tissues is followed by physiological renewal, and the activity of the renewal is regulated by the rapidity of the waste. There can be no health without exercise in the open air. Sedentary life is generally connected with the breathing of air containing excrementitious gases and organic matter which has been thrown out of the lungs, and also the absence of the beneficial influence of sunlight. Inactivity, impure air, and absence of sunlight, when thus combined, produce a fearful mortality, and principally from pulmonary consumption. The deaths of farmers at the age of thirty-five to forty years is given as nine in one thousand, while that of tailors was fourteen, and of bakers, fifteen in one thousand. Lombard, as given by Dr. Clendenin, of Cincinnati, exhibits trades in relation to the prevalence of consumption. In every one thousand deaths these proportions:[1] —

Occupations with vegetable or mineral emanations, 176 deaths.
With various dusts, 145.
With sedentary life, 140.
With workshop life, 138.
With dry and hot air, 127.
With stooping posture, 122.
With muscular exercise and active life, 89.
Living in the open air, 73.

In-door Life. Dr. B. W. Richardson states that no exciting cause of consumption is so general as in-door occupation. Two, out of every three, patients with consumption, who presented themselves at his infirmary, were

[1] *Public Health Papers;* American Public Health Association, vol. i. p. 53.

found on inquiry to be employed in some in-door business. Dr. Richardson's statistics are valuable because the cases from which they are derived were examined with great care by Drs. Davis, Powell, and himself. Of the 515 cases thus seen, 68.34 per cent., or rather more than two thirds, were of persons with in-door occupations. Of the 3,214 consumptives who became inmates of the Brompton Hospital, in ten years, 1,812 (more than one half), had in-door employments. Among the in-door occupations which presented the largest number of cases in this list, boot and shoemakers rank first; needlewomen second; watch and clock-makers third; domestic servants fourth; painters and tailors, printers, writers, cigar-makers, come next in order, — most of them city occupations. These have not only impure air and frequently sitting postures, but they inhale foreign substances, such as sand and glass, in the sand-paper factory; dust and particles of cotton, flax, and others, in textile factories; particles of metal, etc., fragments of hair, in brush factories. These inhalations of the various dusts are a fruitful cause of consumption, because they inflict mechanical injury which is followed by inflammatory products, and these degenerate into destructive diseases of the lungs.

Dampness of Soil. We have already alluded to Dr. Bowditch's and Dr. Buchanan's papers on the subject of soil dampness in producing pulmonary consumption. It is not exclusively a city influence, but there is no denying the fact that parts of our cities are built upon marshy ground, where the cellars are not only damp, but where, after heavy rains, they contain water frequently in considerable quantities. In many of our streets the water that passes between the stones remains there for a long time. The sun does not reach it. Many of the narrow streets never see the sunlight! The reports of the Irish Census Commissioners show *the mortality from consumption, in the spring months for ten years, to be twenty-two thousand more than at any other season.* It is the transition season when there is a quantity of winter dampness given off, and there are great variations of temperature. Dampness of houses exerts an influence injurious to health. The air that is overcharged with moisture hinders the passage of heat from the earth, and it affects the health by preventing the evaporation from the skin and lungs. The temperature of the air, or its evaporative power, modifies these effects.

Positions where the soil is of gravel allow the moisture to pass more readily down than where it is of clay, and many city houses are built on a clay sub-soil. The walls are of soft, porous brick, and in the upper stories frequently not more than nine inches in thickness; through these the driving northeast winds force the rain, and the inner plastering becomes saturated, and we frequently meet with moist wall papers with mouldy paste and sizing. In addition to this faulty material we have often wood used in the construction of the doors and floors which has not been perfectly seasoned, and consequently contains an unhealthy amount of moisture; the mortar used is often imperfectly prepared. This assuredly is not according to Dr. Richardson's high standard of sanitary excellence! This excessive amount of humidity is found principally in the houses of the poor.

Among the better classes we have in winter the opposite condition to contend against — excessive dryness from overheating, and not supplying water for evaporation. This is a great cause of irritation to the lungs and causes such dryness of the surfaces of the bronchial tubes, that it produces cough and not unfrequently hemorrhages. In fact, persons who wish to avert hereditary pulmonary consumption should keep in their houses dry and wet bulb thermometers, — and when so desirable an instrument is invented, one to test easily the percentage of carbonic acid in the atmosphere.

The over-heating of houses, especially by hot-air furnaces, is a daily influence calculated to develop pulmonary consumption. The in-door and the out-door climates being so different in temperature, and the degree of moisture, the sudden change from one to the other necessarily affect the lungs. With the temperature moderately high, and the air dry, respiration goes on well and comfortably. The amount of oxygen taken in is normal; the vapor, the carbonic acid, the organic material, and the ammonia are easily thrown off; the circulation of the lungs is natural, the exhalation from the skin is free, and the animal heat regulated. While this the in-door life, the individual goes out with a change of probably thirty or forty degrees, all the processes we have spoken of are altered and disarranged. The shock causes a jar in the machinery; a pneumonia, or a bronchitis, or a pleurisy result in the predisposed to consumption. It is lighted up, and no one can tell the end.

Over-crowding. It is unnecessary for me to speak of the over-crowding of the population as a city influence which develops rapidly pulmonary consumption. It involves necessarily an atmosphere impure from breaths, and deprived of its oxygen and also filth and animal or organic matter suspended in the air. It is usually attended with indifferent alimentation, and low vices, which, of themselves, poison the tissues. In New York, with an average of 5.07 persons in each family, there are 14.72 in each dwelling!

City Life and Occupations. There are a number of other influences of city life that seriously interfere with nutrition, and thus develop pulmonary consumption. They begin with the very birth of the human infant. Its first breath is frequently of air that is contaminated by the breath of others. For hours previous to its birth the room has been occupied probably by more persons, anxiously awaiting the arrival of the heir, than are sufficient to breathe the atmosphere over several times. Two thousand cubic feet for each person every hour will soon exhaust the atmosphere, unless the room is a very large one. Unless the air outside is above 75° F., those who have charge of the mother are unwilling to open the windows. This atmosphere, thus contaminated and getting hourly more impure, the helpless little mortal continues to breathe, and benumbed to sleep by the increase of carbonic acid it is utterly unable to protest by its cries against such wanton cruelty. It is entitled to an air full of life and of over twenty per cent. of oxygen with an infinitesimal amount of carbonic acid. If it could express its feelings, they would make it cry aloud at such torture; but poisoned by the excess of carbonic acid, it sleeps profoundly, so much

so as to cause anxiety, and the medical attendant is not unfrequently called to find out the cause. The nurse, from ignorance of the mechanism of respiration puts the abdominal bandage so tight — the tighter the better she thinks — that she interferes with the action of the diaphragm and the elasticity of the ribs. The lungs are thus prevented from thoroughly aerating the blood. The compressed nummies show their uneasiness and discomfort by their cries, which are misinterpreted to mean pains of colic, for which they must be dosed. Not only is the air unfit for developing their tissues, but the food given is frequently indigestible ; cane-sugar cannot be digested by them except in very small quantities, yet the nurses freely administer it to them, and physicians are often utterly powerless to prevent it. Moreover, their limbs are restrained in their movements by the long tight clothes. It is evident to every superficial observer that tight bandages and the fine clothes prevent them, when old enough, from playing out of doors. If they have any yard to play in it is probably so shut in that the sunlight does not reach it. As soon as the child is old enough to get into mischief it is sent to spend the best hours of the day in winter, especially, in the vitiated air of a crowded school-room, where children are expected to learn and understand and remember rules of grammar and innumerable answers in geography ! Why is it that young children cannot be allowed to play out in the morning in the sunlight, and learn and recite their lessons in the afternoons when they cannot go out ? The effect of their going to school in the morning is to deprive them of out-door exercise in the sunlight. Thus at an early age the body suffers directly from confinement indoors and indirectly from over cultivation of the mental faculties. If the child escapes tubercular meningitis it will in a few years later perhaps be carried to an early grave with tubercular or inflammatory diseases of the lungs. If not then, sooner or later from these defects in physical education the hereditary weakness will be shown, and some acute shock to nutrition will cause the explosion, and destructive disease of the lung will be the result.

Imperfect Alimentation. There is one cardinal error in raising children, which we must consider as a very important influence in developing pulmonary consumption. It is as to their alimentation. They do not get proper food in sufficient quantities and frequently enough. This is the case not only among the poor who have the excuse of not being able to afford it, but among the well-to-do and the rich. Children that are growing and developing need, in proportion to their weight, more food than those who have attained their full proportions and who require enough to repair the effects of their waste, simply to keep their nutrition. Children need material for their formation in addition, and they necessarily need that kind of material that adds energy to their formative forces. Dr. Erasmus Wilson wrote some years since a suggestive little book on the necessity of giving meat to children, who have their first set or deciduous teeth, three times a day. In meat the predominating nutritive principles are the nitrogenized, which form the basis in which we have the manifestations of life. Children digest it readily, and it is flesh forming. But young children ought to have

substantial meals five times daily and as much as their stomach will digest, and if allowed plenty of out-door exercise in pure air they are literally ravenous. All varieties of food should be given to them, for they are all tissue making, and it is by firmness and strength at the early periods of life that they acquire strength to resist causes that test the solidity of their health. Among the poor we all know the impossibility of supplying them with food in proper quantity, but even among the rich its importance is not appreciated. In cities, milk and butter, which contain all elements of nutrition in their most easily digested form, are not taken as freely as is necessary, partly from the difficulty of procuring them as pure and fresh as in the country, and partly on account of the misconception in regard to their true value. We claim that in next importance to the purity of the atmosphere as an influence upon the nutritive functions in warding off consumption, comes that of the proper estimate of the value of the various ailmentary principles. Dr. Erasmus Wilson was correct in urging upon parents the necessity of giving young children freely of meat, rich as it is in nitrogenous matter, for it supplies materials for nutrition and the secretions, and contributes to the production of fully nourished and vigorous organisms. It is the constructive material and is the instrument of action. But the modern researches of Lehman, Fich, and Wescelinus, Dr. Edward Smith, Pavy, and others have established, we think, the fact that, nitrogenized material instead of passing into tissue and thence by oxidation giving rise to the evolution of force, five sixths of the amount consumed undergoes (probably by the action of the liver) a metamorphosis into urea, which carries off the nitrogen as an unavailable element through the urine!

According to Dr. Edward Smith and Dr. Pavy, the great bulk of the nitrogen of the food ingested passes out of the system in the form of urea. We cannot, of course, consume the time to detail the experiments of these observers, but we consider that they have modified Leibig's views in regard to the force-producing power of nitrogenous food. The nitrogen of the urine is not the product of muscular and nervous actions destructive of the tissues, but is directly in proportion to the nitrogen taken in the food. When nitrogenous matter is not supplied in due quantities it is taken from the textures of the body, but muscular force is not produced by nitrogenous material. If, then, muscular action is not the result of, and is not to be measured by muscular destruction, to what then is the energy manifested to be ascribed? To nothing else than to that deleterious gas, which we have found so destructive to health and life when it has accumulated in the atmosphere, — carbonic acid. The doctrine of the present day teaches the source of muscular power to be the oxidation of non-nitrogenous matter. The elimination of carbonic acid is increased by muscular work, and is directly in proportion to it. This fact, which Dr. Edward Smiths' and Fich's experiments have apparently settled, enable us to refer the production of muscular force to the oxidation of hydrocarbonaceous matter. The oxidation of this class of alimentary principles as a prominent cause of the production of animal heat has long been acknowledged. This new fact is another illustration of the indestructibility of force. It may be transmuted

from one manifestation to another, from chemical enegy into heat, from heat into mechanical power, from that into electricity.

Deficient supply of Butter. We have alluded to these facts simply to call the attention of the Association to an influence more especially felt in cities, which we believe has a marked effect in developing pulmonary consumption. The neglect of supplying to all in sufficient quantities, but especially to the young and to the growing, that which is most easily digested and most nutritious of hydrocarbonaceous materials, — butter. We confidently believe that one of the causes of the healthfulness of country reared children is that they are amply supplied with fresh butter. It imparts to them a muscular force, it keeps them warm. When they swill their bowls of milk, they drink in with their caseine, as a basis of structure, the bone element, phosphate of lime, and the heat and force producer, butter. In town it is impossible, especially in hot weather, to supply milk in abundance, and pure butter as freely as it ought to be even to those who can pay for it. In the country a man must be very poor to be without a cow, but in the town the poor have indifferent milk and but little of it. They never get butter enough. This highly nutritious element of food, butter, is thoughtlessly or rather ignorantly often deemed as a cause of what is termed biliousness, when it is the digestive powers that are at fault and not the food. Butter gets the credit which it does not deserve, of being gross food, and of spoiling the complexion of the fair sex — when it has nothing whatever to do with it.

All Diseases. We further claim that all diseases which affect profoundly the organism may, and frequently do, give rise to pulmonary consumption. They impair the forces of the body, and the lungs, the most sensitive part, suffer in their nutrition. As in health the lungs administer to the maintenance of the tissues, and any deficiency in the workings of the lungs affects them instantly; so in turn do the lungs feel any perversion of their functions. Inflammations everywhere produce too much bioplasm with loss of formative force. We daily meet with cases of consumption where the starting point was an illness. The organic poisons of small-pox, measles, typhoid fever, are frequently followed by destructive diseases of the lungs. Bright's diseases, diabetes mellitus, are often complicated or followed by phthisis. Of the 899 diseases which the College of Physicians of London tell us afflict the human race, a large number of them leave a weakness of life force.

Applying Dr. Playfair's method, Dr. J. R. Black estimates that in New York and Philadelphia nearly three fourths of the entire population are sick in some way each year. Here we have a prominent cause for the development of pulmonary consumption. Ought we to be surprised at the fearful number of cases of this disease occurring in every large city?

City Hospitals. Investigations into the sanitary conditions of city hospitals, unless of modern construction, show that they exert an influence which is calculated to develop pulmonary consumption. Illy ventilated wards crowded with patients, the beds not two feet apart, the very walls saturated with animal emanations, and the atmosphere containing large pro-

portions of carbonic acid. The living and the dying lying side by side, day and night, the delirious and the fever patients keeping awake by their groans those who could sleep if otherwise situated. Into such wards cases of pneumonia, bronchitis, and pleurisies, are promiscuously thrown. Is it astonishing that the acute respiratory diseases are slow in recovering, and that inflammatory products do not disappear, but undergo cheesy degeneration, and destructive diseases of the lungs or pulmonary consumption is developed?

Other City Causes. The lateness of the hour, and the time I have already consumed, prevent my speaking of other civic causes which are instrumental in a greater or less degree in developing pulmonary phthisis. Irregular habits of eating, late dinner hours, the deprivation of sleep (which nature intended should take one third of our hours to refresh us for the other two thirds work), the close confinement to business, the worry and anxiety of speculative business, the over mental work of students, — all these, and whatever interferes with the integrity of the organic and vital functions, tend to the impairment of the vigor of the body, and thus predispose to inflammatory and tubercular diseases.

Of the curability of Consumption, even after it has manifested itself, we need only speak of the fact reported by M. Roger that at the autopsies at La Salpêtrière in Paris, the Hospital for the Aged, fifty-one per cent. of the lungs examined contained evidences, — such as cacatrices and calcareous nodules — of their having had during life tubercular or other destructive diseases. *We confidently assert that there is no chronic disease which can be so controlled in its development by sanitary and hygienic laws as pulmonary consumption.* In cities there is no denying the fact that the hereditarily predisposed have to go through trying ordeals which test their force of resistance to the utmost. City habits, city houses, city life, and city occupations, all conspire against them. In cities the young mature earlier, the adults live faster and they die earlier, and Consumption maintains its supremacy in its large percentage of the deaths. Let us not despair of decreasing still more the mortality from this frightful scourge. When people build let them examine well the soil of the foundation, and also see that the walls are constructed as Dr. E. M. Hunt and Dr. Richardson would direct.

Lessened Mortality. Dr. George Derby, of the State Board of Health of Massachusetts, in his article on the Prevention of Disease, in 1870, gives us the records of consumption in Massachusetts, as derived from the census of 1865, which states the gratifying fact that private and public hygiene are really diminishing the mortality of this disease in that State. It shows that the number of deaths does not increase in proportion with the population, and that comparing the first group of five years with the last group of five years, it is shown that the annual gain in each 100,000 of the population is 54 lives; "this gives," says Dr. Derby, "as the actual saving of life in the last five years 3,440 persons, or 688 in each year." Deaths from consumption in Massachusetts have diminished by that amount, and the improvements seem to be going on. Dr. Derby expresses his belief that this is owing

"to the advance of medical science, which has given to physicians a better knowledge of the nature of the disease, drawn from its pathology; a better mode of treatment derived from a careful observation of cases; from modern discoveries in chemistry and physiology; and a greatly improved acquaintance with the means by which consumption may be avoided by those predisposed to it by inheritance, derived from all these sources combined."

We believe that it is not only from a more intimate knowledge of the disease itself, and its appropriate treatment, that this mortality is lessened, but by the fact of the recognition by the profession of the principles of rational practice and of conservative medicine in the treatment of all diseases; for, as we have seen, whatever profoundly affects the organism and shocks the nutritive functions, may be the means of developing consumption. The essential fevers, which are frequently followed by pulmonary phthisis, are now controlled and guided to a safe termination, instead of the sufferers being overdosed and deprived of those hygienic conditions necessary to the restoration of health. We have also the hygienic treatment of all diseases, which is the medical fact of the times. It is more especially from the improved treatment of inflammatory diseases in general, and those of the lungs in particular.

The pneumonias are now treated on the restorative plan, in simple recognition of the fact that inflammatory action, no matter where met with, does not ordinarily need depletory remedies, such as venesection, starvation, antimony, and mercury, — the great spoliatives; but that it is in its intimate nature an evidence of depressed and not exalted force, and that its products are preëminently so. The imaginary phlogiston of the past theories is no longer recognized as something to be subdued by antiphlogistic remedies. Now, by the aid of hydrotherapy, quinine, digitalis, and other antipyretic agents, we prevent the exalted temperature from producing paralysis of the heart and brain. We thus sustain and save life. With the quinine in large doses we do more still. We control in croupal pneumonia the amount of exudation by its wonderful power of arresting the migration and subsequent rapid increase of the white blood corpuscles. We thus ward off pulmonary phthisis.

For this modern treatment has not only decreased the mortality in pneumonias, which has improved from $33\frac{1}{3}$ per cent., or at least 16 per cent., to $2\frac{1}{3}$ per cent., but it also materially lessens the danger of degeneration of the plastic material thrown out in pneumonias. Thus this protoplasm of lowered vitality can be and is absorbed, instead of remaining to undergo in the organism, exhausted by the continuous high temperature of days, caseous degeneration, and finally, phthisis from inflammatory origin.

The organism, to recover from the products of inflammation, requires all the strength and vigor that can be imparted to it by alimentation and by tonics.

But perhaps the most encouraging prospect for the diminution of the mortality in pulmonary consumption is the greater appreciation of the true principles of the philosophy of food, — alimentation in disease. The imperative necessity of food for the sick, as well as for the healthy. Disease

being only a perversion of health, a lowering of the physiological status, the body requires food to replace the waste that is uninterruptedly going on under all circumstances, and it must be supplied if it is possible to get the stomach to prepare it for assimilation.

There is no condition which does not require food, inorganic and organic, if it can be given and digested. Without due supply in acute diseases of the respiratory organs there is not only, if the patient recovers, protracted convalescence from the acute symptoms, but there is imminent danger of what Hippocrates appropriately called unresolved Pneumonias, which, we have seen, are nothing more nor less than a form of pulmonary consumption.

Let us see that the sunlight enters the dwelling freely, that the outside air is drawn in and the inside air thrown out continually ; let us insist upon the proper alimentation of our household, and upon our children being well protected by clothing from the changes of temperature and moisture of the atmosphere ; let us avoid intemperance, which causes at least two per cent. of the deaths from phthisis, and take regular outdoor exercise, and when our children are young let us send them to the country for five months of the year, when we can do so. When parents choose fields of usefulness for their children, let them bear in mind the demonstrated injurious influence of in-door and sedentary occupations. In one word, let them observe the laws of health which nature has given them. This done, we believe hereditary tendencies to consumption will be overcome in a great measure, and acquired consumption much less frequently met with. Dr. Richardson does not overstate the decrease in mortality in his ideal "City of Hygeia," when he says that the victims of the deadly foe, consumption, would be reduced at least one third.

Let us work for so desirable a result, and continue to urge improvements in sanitary conditions of the people, and the observance of the laws of Hygiene, until we verify M. Flourens' estimate of one hundred years as the natural period of human life.

HEALTH OF TENEMENT POPULATIONS AND THE SANITARY REQUIREMENTS OF THEIR DWELLINGS.

BY EDWARD H. JANES, M. D., OF NEW YORK.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 10, 1874.

IN studying the important question of public health in its various relations, and especially as it regards communities of any particular class, we shall find that the degree of aggregation, or the dwelling of people in masses, must be recognized as a condition which bears very decided relations to the health of man as well as to the future development and sanitary interests of his offspring. There are certain general causes, such as mode of living, personal habits, and the variety of circumstances by which the individual is from time to time surrounded, which apply to all classes of persons, and which affect health either favorably or unfavorably in proportion to the varying degree of regularity with which well known hygienic laws are observed. While man must look well to the supply of his physical necessities as one of the primary conditions upon which he may expect the enjoyment of sound health, he is also largely indebted to his social surroundings for the degree of his physical perfection, as well as for the standard of his intellectual and moral excellence, each individual yielding somewhat to the stronger influences emanating from his immediate associations, being reduced to a lower grade when these associations point in that direction, either mentally, morally, or physically, or possibly elevated when the tendency of the surrounding influences is progressive and upward. These social influences exert their power, either good or bad, upon all who come within reach, and hence aggregation of population carries with it an effect like that of the pressure of fluids, tending to reduce to a common level the general mass.

The hermit, having grown misanthropic as a consequence of some misplaced confidence or social obliquity, becomes a stranger to the instincts and friendships connected with social life, for want of some object to call them into exercise; while his mode of life being such as to deprive him of the delicacies of civilization, and surrounded by the works of nature unmodified by art, may secure to him long years of life and health, notwithstanding his frequent exposure to vicissitudes of weather and sudden or irregular changes of temperature.

The wandering gypsy, exposed to all kinds of weather, and inured to hardships, acquires by such exposure a certain degree of exemption from the dangers which through the same experience would seriously threaten the welfare of persons in civilized life. Leaving these offshoots from society as of no further interest to our subject, we turn to society itself, which, for our present purpose, may be divided into three general classes,

as regards their exposure to certain causes the tendency of which is to affect in some degree the physical, mental, and moral health of our race. The first two must receive here but a passing notice, and may be made to include the rural population, and the well-to-do in cities and towns. Those belonging to the first class, as is well known, live scattered and are in theory the most favorably situated for the promotion of health and the enjoyment of long life, while the facts are that ignorance of hygiene or a culpable negligence of its laws, will too often cause disease and death in the rural districts, from defective local conditions which are entirely within the power of man to remedy. For want of proper drainage of the soil, malaria is allowed to spread its influence over extensive areas, and fevers in their various types are found where health and happiness ought to beam from the faces of all.

Dwellings erected without any reference to the nature or condition of the ground, perhaps on undrained and retentive soil, are continually, by their walls, absorbing moisture and imparting a dampness to the internal atmosphere of the house, which for this cause too often becomes the home of catarrh, consumption, or rheumatism; while children sicken and die of croup or pneumonia resulting from a residence over damp and perhaps unclean cellars, or between walls saturated with soil moisture which should have been removed by proper drainage. And again, dysentery and other intestinal diseases of a typhoid character assert their presence, often adding largely to the rate of sickness and mortality in just retribution for the violation of sanitary laws, as evinced by the too close proximity of wells to cess-pools, converting that emblem of purity, nature's beverage, into a liquid purveyor of the seeds of disease and death.

The proper relation of water to the dwelling is to a great extent the key to successful sanitary effort. In the first place it should be removed as completely as possible from the ground upon which the house is to be erected, and furthermore, the foundation walls should be provided with additional protection from soil moisture, by the intervention of some absolutely impervious material. A thick layer of cement on which the foundation wall may rest, and another layer carefully applied between the wall and the adjacent ground, and extending one or two feet above the surface, would in all probability fully prevent the absorption by the walls of any moisture from the ground. The well needs especial attention in order that the purity of the drinking water may be preserved, and with this view it should be located at a distance from any source of impurities, and all drains and cess-pools should be so constructed, and waste refuse should be disposed of in such a manner as to avoid any danger of contamination by leakage or percolation. The methods of warming now generally adopted in the modern built country-house, substituting the cast-iron stove or the hot-air furnace for the old-fashioned open fire-place, and the consequently inferior systems of ventilation, are calculated to render persons more susceptible to the influences of sudden changes of temperature, and doubtless contribute not a little to the aggregate amount of sickness and mortality in the rural districts.

With this brief allusion to the sanitary features peculiar to country life, we turn our attention to the city, and find, contiguous one to the other, the two remaining classes: namely, the rich and middle class, who to a certain extent are provided with the comforts if not with the luxuries of life; and the poor, who depend for their livelihood upon their daily toil, and while at home breathe the impure atmosphere of crowded tenements, and are subject to other evils of which mention will be made presently, all connected directly or indirectly with a want of the proper proportion between numbers and space.

The rich, though apparently beyond want, are not entirely exempt from causes of disease which are immediately connected with their homes; causes which operate far more during the winter than the summer, as in the latter season they are either freely ventilated by means of open windows, or are closed entirely, their occupants being absent in the country. Impurity of the atmosphere may be regarded as the prominent home cause of disease among the rich. The hot-air furnace, which is the heating apparatus in general use, furnishes for respiration an atmosphere elevated in temperature, wanting the proper degree of moisture, and generally contaminated to some extent with the deleterious products of combustion. Of these, carbonic oxide is the most to be feared, although it is the popular opinion that carbonic acid is the principal poison emanating from burning coal. But while the latter poisons by depriving the individual of the proper amount of oxygen, the symptoms being relieved whenever the atmosphere becomes restored to its original purity, the former is more lasting in its effects, acting as a direct poison, destroying the blood corpuscles, and leaving its traces long after removal of the cause, as is apparent in the sickly countenances and general listlessness often manifested by the children of the rich. The fact which is now generally admitted, that this gas readily finds its way through cast iron when heated to redness, should be a sufficient warning to all who adopt the cast-iron stove or furnace as a means of warming their houses or apartments, lest the want of proper care should lay the foundation for future ill health, the inevitable consequence of breathing an atmosphere contaminated with this treacherous poison. As it is the product of partial or imperfect combustion due to a deficiency in the supply of oxygen, this fact should warn us against the too common practice of tightly closing the draft and damper with a view of saving fuel, or preventing the escape of heat, as such economy is likely to be at the expense of sound health. But this is not the only source of atmospheric impurities which invade the homes of the rich. While the red-hot furnace distributes its heated and poisoned air throughout the several apartments of the dwelling, during the evening the atmosphere is further deteriorated by the combustion of large quantities of gas, the products of which float through the unventilated apartments, each moment rendering the air more and more unfit for respiration. In addition to these causes of ill health, it may also be noticed that imperfect plumbing operates in the same direction, more freely in winter than in the summer, owing to the suction caused by the heated and rarefied condition of the atmosphere in the house, as com-

pared with that in the sewers and house drains during the cold season. The frequent indulgence of the rich in luxuries and dissipation presents additional exposure to the frequent attacks of disease.

The third class, or tenement populations as they exist in cities and large towns, and constituting the principal subject of this paper, must now be considered, as among them are found by far the greatest amount of suffering, sickness, and mortality, being the evil results following defective systems of domestic hygiene. Among the insidious though manifold causes of ill health which may be enumerated as operating upon tenement populations, may be mentioned as foremost, and giving rise to a variety of evils, the want of a sufficient amount of air space, thus limiting the supply of that vital agent, the inhalation of which is the first and most important physical act of our existence. In order that the blood may be properly relieved of its waste material, the work of the brain and all of the physical functions be duly performed without interruption, and the powers of digestion and assimilation maintain their normal degree of activity, it is absolutely essential that the air respired be free from impurities and rich in oxygen, the real life-supporting element. This cannot be obtained in the pent-up quarters of tenement houses, where the air respired becomes loaded not only with carbonic acid, the product of respiration, but organic exhalations also, from the lungs and bodies of persons occupying these crowded apartments, to say nothing of the various other impurities inseparable from the average condition of tenement populations. These organic impurities, it must be remembered, do not possess the diffusible property of gases, and hence will not so readily escape from an apartment supplied with ordinary means of ventilation. On the contrary, they are persistent in their nature, they adhere with a peculiar tenacity to the walls of an apartment, to clothing and furniture ; or they float about in the confined atmosphere, making their presence known by that peculiar odor which when once detected is not easily forgotten, indicating the presence of dead animal matter, and generally recognized as the "tenement house smell."

It is this odor which indicates the commencement of that condition known as a crowd-poisoned atmosphere, and which, if allowed to increase, furnishes the specific germs which develop typhus, ship, or jail fever. If our senses are acute we begin to detect the odor whenever the proportion of carbonic acid from respiration exceeds that of six parts in ten thousand, which Dr. Parkes calls the extent of permissible impurity ; and when it is once detected, it should be received as an indication of crowd poison, and the fact should be recognized that at least one step is taken towards the condition of the "Black Hole of Calcutta" in 1756, or of the ship *Londonderry*, nearly one hundred years later, the accounts of which are doubtless familiar to all American readers.

Nothing, perhaps, will better illustrate the average condition of tenement houses in large cities, than the records of a sanitary survey made in the city of New York in 1869, under the direction of Dr. Elisha Harris, Sanitary Superintendent, by order of the Metropolitan Board of Health. By referring to these records, we find that 14,494 tenement houses were care-

fully inspected,[1] of which 2,530 were rear houses, or houses each occupying the rear portion of a lot, with a large house in front, obstructing the view of the street, and to some extent the air and sunlight. In 1,532 of these houses, the drainage was very bad, endangering the health and lives of the occupants; in 2,178, the privies were neglected and filthy; and in 5,514, the garbage and house refuse were allowed to accumulate in the cellars and yards, or to obstruct the street gutters in such a manner as to defile the atmosphere for a considerable distance around.

People living under circumstances so opposed to their sanitary interests, and being year after year exposed to the morbid influences arising from defective hygiene, must from necessity yield to those influences, and in time, deteriorate in health as well as in social standing. Of course reference is here made to crowded tenements where want of sufficient space renders cleanliness the exception rather than the rule; and especially where to a want of space is added a want of ventilation sufficient to expel and entirely remove these atmospheric impurities, and to furnish pure air in quantities adequate to the support of healthy respiration.

Defective house drainage has for a long time been recognized as operating unfavorably on the health of tenement populations. When it is remembered that waste pipes and house drains communicate with public sewers, the office of which is to receive all kinds of refuse and filth, and that the

[1] In these 14,494 tenement houses, there were found 113,402 families, an average of a little over seven families to a house, and a total population of 463,392, of whom 4,874 had never been vaccinated. This last item is but a distant approximation to the real truth, as many of the occupants of houses were absent from home at the time of the Inspectors' visits, and consequently the facts in regard to vaccination could not be ascertained. Had it been possible to obtain complete information in regard to the statistics of vaccination among the occupants of tenement houses, the numbers of unvaccinated persons would probably have been very much larger. In regard to the ventilation of this class of dwellings, these records show that 6,258, or nearly one half, had no through and through ventilation, by which is meant that there were no means provided for a current of air to pass directly through front and rear apartments. This deficiency arises from the fact that front and rear apartments are usually occupied by different families, who, in order to keep entirely separated one from the other, are in the habit of securely closing the doors and windows which communicate between the rooms; and this obstruction of communication prevents the circulation of air, rendering the contracted apartments close and oppressive. The Board of Health has caused an improvement to be made in this respect, by requiring these rooms to be made to communicate with the hall by means of transom windows, and the hall to be ventilated by means of a properly adjusted ventilator in the roof, so as to allow a circulation of air through each room in the house. The amount of cubic space allowed to each individual, and estimated by cubic feet, was as follows: In 422 houses, the cubic space allowed to each individual was 200 feet or less; in 2,408, it was from 200 to 300; in 3,006, it was from 300 to 400; in 2,715, it was from 400 to 500; in 1,980, it was from 500 to 600; and in the remainder, the amount of air space varied from 600 to upwards of 800 cubic feet. The sleeping rooms, in which from one fourth to one third of the life is passed, afford much less of cubic space than is afforded by the living rooms. These measurements make no allowance for space occupied by furniture, bedding, clothing, and various articles which are often stowed away in tenement houses, and which, if considered in the estimate, would still further reduce the dimensions of breathing space. I might add also that 2,095 of these houses were reported as being very dirty; and in 587, home trades were carried on, having the effect of increasing the impurities of the atmosphere in proportion to the number of persons engaged in whatever work may be carried on.

construction of these pipes and drains is often imperfect, especially in the cheaper kind of tenement-houses, it requires no effort of the imagination to appreciate the danger to health arising from the escape into living and sleeping rooms of the gaseous products of decomposing sewage matter, thus adding to an atmosphere already contaminated with the products of respiration, the additional poison of sewer gas. The effect of this condition is, to so lower the standard of health, or to so weaken the powers of resistance as to render persons inhaling such an atmosphere easy victims to any epidemic or endemic influence that may, for the time being, find lodgment among them. Thus it has been shown in previous years, that prevailing diseases, whatever they may be, reap their greatest harvests in neighborhoods filled with badly constructed and over-crowded tenement houses, with the corresponding amount of decomposing refuse matter. Besides the conditions above mentioned, it is found that large numbers of tenement houses are built upon what is known as "made ground," which is formed by the filling of depressions, or filling up low ground naturally covered with water, and not subsequently prepared by proper drainage. The effect of omitting the necessary drainage of the ground previous to the erection of buildings may be seen in the damp walls, the wet cellars and basements, or it may be felt in the damp and chilly exhalations constantly arising from the saturated soil, often rendered doubly dangerous as well as offensive by the decomposition of organic matter, consisting largely of house refuse mingled with the material used in filling, grading, and preparing the ground. We also see, as a peculiar feature of tenement house life, the too close proximity of sinks and cesspools, which send their mephitic odors into the surrounding atmosphere, to find entrance to the house by open doors and windows, and to exert their sickening influences to the detriment both of the health and morals of the inmates. In neglected tenements these vile odors are often so offensive and persistent, as to render the open window an avenue of discomfort rather than an adequate means of ventilation, and summer days and nights are often more comfortable in the confined atmosphere of the dwelling with closed doors and windows, than when entrance is given to these suffocating volumes of cloacal effluvia.

Improper disposal of house refuse was found to be a crying evil of considerable magnitude in more than one third of the entire number of tenement houses inspected on the occasion referred to. This improper disposal of refuse consisted in neglecting to remove it from the premises, where it was allowed to remain until putrefaction set in, thus defiling the yard, the cellar, and the street gutter with decomposing organic matter, mingling its gaseous emanations with the atmospheric impurities already mentioned. Huge garbage-boxes on the sidewalk, saturated with the fermenting drainage of their contents, or large accumulations of garbage deposited in the street, and allowed to remain there for days, festering in the summer sun, are active causes of intestinal diseases in crowded neighborhoods, where filth increases in proportion to numbers, as is the inflexible law of supply and waste. These various causes, operating not only to contaminate the atmosphere of a tenement house, but to defile also the walls, ceilings, cloth-

ing, and furniture with organic waste, it follows that, where sickness occurs amid such surroundings, the exhalations from the sick find the same harboring places, and disease germs and contagion find a congenial soil in which they may remain for a long time dormant perhaps, ready to be called into action whenever susceptible persons come within their influence. The persistency with which contagious and infectious diseases adhere to certain tenement houses and tenement neighborhoods, is well known, and is generally recognized as one of the effects of causes above mentioned, and is overcome only by the most rigid system of cleansing and disinfecting.

The cheerless condition of a neglected tenement house, the devitalized condition of the atmosphere inhaled by its occupants have the effect to gradually enfeeble the vital powers and to create a desire for stimulants, which, being indulged, deprives the family of a sufficient amount of proper nourishment, and gradually paves the way to disease, intemperance, and crime; the father of the family, becoming dissatisfied with the cheerless condition of his home, spends his evenings elsewhere, probably at the alehouse, to the neglect of his family, wasting the scanty earnings which are needed to supply the wife and children with the necessaries of life, thus depriving them of the first conditions upon which they can expect to acquire and enjoy a reasonable degree of health. The large number of tenement houses, the first floor of which is occupied for the sale of intoxicating liquors, probably contributes largely to this latter evil, as the convenience is a great temptation not only for the male members to resort for the purpose of whiling away their time, but for providing the other members of the family with ale or some cheap alcoholic stimulant. It is in houses of this class that we may expect to find Bright's disease, delirium tremens, or some form of alcoholism.

The kinds of labor among tenement populations are not without their influence on physical and moral health. It is estimated that in the city of New York and its environs, not far from one hundred thousand children are engaged in factory labor, to the neglect of their moral training, and in a majority of instances to a disadvantage as regards good physical development. It is quite natural to assume that a very large proportion of these children belong to tenement populations, and indeed investigation appears to support this assumption. We must therefore regard the confined atmosphere in which many of them labor, with the emanations and dust from the various materials manipulated, as bearing no favorable comparison with the breathing space afforded by their pent-up homes, to say nothing of the degrading moral and social influences resulting from systems of factory labor pursued at the present day. Nursing mothers who are obliged to go out to work by the day in order to assist in obtaining the necessities of life, whether it be factory labor or ordinary house-work, are by this practice placed under the necessity of depriving their infants, to some extent at least, of the food which nature designed for them, and artificial feeding is resorted to in part, with the effect of an increasing tendency to diarrhœal complaints, and a lower standard of infant health.

Carrying heavy burdens up several flights of stairs is one feature of labor almost inseparable from tenement house life. From this results a large amount of female suffering due to abortions, uterine displacements, and other affections peculiar to the female organism, and brought about by excessive, or wrongly directed physical exertion; and again of distorted spines, or other deformities in younger persons and children, due to similar over-exertion on the part of those who are too young to bear with impunity the burdens placed upon them. Men who work at their homes, as was found to be the case in 587 tenement houses, such as tailors, shoemakers, and persons of kindred occupations, add to the impurity of the atmosphere by their presence, which, with the confined position maintained during the hours of work, renders them easy victims to dyspepsia or consumption.

Much needs to be done towards improving the sanitary condition of the dwellings of tenement populations, and for this purpose it is hardly necessary to say we should commence by avoiding those evils which have been already pointed out. More air-space, better ventilation, improved systems of house drainage, are the self-evident necessities which apply to nearly all tenement houses; these provisions, preceded by careful preparation of the ground for building spots, especially as regards subsoil drainage, by relieving the ground of moisture, and thoroughly protecting the walls with cement, will secure dryness to the walls, and comfort and cheerfulness to the in-door atmosphere.

As house drainage bears so important a relation to the sanitary condition of a house, too much attention cannot be given to the perfecting of this department of architecture. The ordinary waste-pipe, with its sigmoid trap, now in use for many years, does not entirely fill the condition required. The trap, by the water it contains, is supposed to present an impermeable barrier to the escape of sewer gas within the dwelling, though, practically, this is not always the fact. It may fail from imperfect construction, as is very often the case in cheaply built houses, or the pressure of gas may sometimes be strong enough to force its way through a well-constructed trap; or again, the trap may be emptied by suction occasioned by the flushing of the house drain during a heavy shower, or of a waste-pipe, as in the discharge of an unusual quantity of water, especially if the pipe be of small calibre; or still again, water remaining in a trap for some time will absorb whatever gas may come in contact with it, and give off the same by exhalation. All of these, with the exception of imperfect construction, may be avoided by a simple system of ventilation, as by a ventilating tube carried from the upper bend of the trap to the external atmosphere; or, what is still better, extending the perpendicular waste-pipe with which the other pipes are connected, through the roof, that the imprisoned gases may escape at elevations which will insure their dispersion. By this simple means the pressure is relieved, and the force of suction prevented.

The disposal of human excreta is a problem not yet satisfactorily solved. The evils attending the old-fashioned midden, such as the abominable odor connected therewith, leakage of fluid contents into the surrounding earth,

contiguous cellars, or wells, to say nothing of the intolerable nuisance of emptying and removing their contents, have all repeatedly been made the subjects for sanitary discussion. With a view of avoiding this vile nuisance, sewer connections are made which are often so obstructed as to utterly fail to accomplish the purpose for which they are intended. Ventilating the vault by a properly constructed shaft, made to extend above the roof of the dwelling, has been found to afford a good deal of relief from the nauseous odors, as they are by this adjustment carried so high in the air as to be destroyed or dispersed before they can descend to the level at which they would be annoying to any one. Emptying the sinks by air-tight apparatus has been proved to be entirely practicable in many cities, both in this country and in Europe, and the operation, when carefully conducted, is shown to be so wholly inoffensive that the work may be done at mid-day, without causing annoyance to any one. Though the dry-earth system seems to be impracticable in large cities, arising from the difficulty in obtaining the earth in sufficient quantities, it has for a long time appeared to me that finely sifted coal ashes might be employed as a proper substitute; and the specimens of night-soil, treated with coal ashes, exhibited by Dr. Lees, of Baltimore, at the meeting of this Association in New York, November, 1873,[1] strengthened my convictions concerning the value of ashes as an absorbent and a deodorizer. Vaults so constructed as to receive no water from the earth by percolation, and none from surface drainage, would be the proper ones in which to try the experiment, as in such we should have only the fæcal matter and urine to be deodorized or absorbed, and there would be no overflowing by reason of obstructed sewers, drains, and heavy storms, and no leakage from imperfectly cemented walls. In order to insure cleanliness and decency in tenement families, and thus to contribute to their health and comfort, the people themselves should be educated to the importance of these measures. Associations with filth and negligence will not fail to beget the same want of order in the most fastidious, who, by degrees, yield to the powerful influences by which they are surrounded; and hence constant effort is necessary on the part of the philanthropic to impart to tenement populations such information as is best calculated to make them understand thoroughly what is necessary for the benefit of their health. This can only be done by a large voluntary effort among intelligent and public-spirited citizens. Charitable associations, church guilds, and similar organizations, might adopt a work of this kind, and, by a course of systematic visiting, in which ladies who fully appreciate the sanitary wants of the poor might engage, a large amount of good might be accomplished towards bettering the present condition of tenement families.

The condition of the poor man is very far from being a matter of indifference to his more fortunate neighbor. In times of threatened pestilence the attention of all is turned with anxious solicitude to the condition of tenement neighborhoods, for it is there that the conditions exist which give to epidemics their greatest power, and to contagion its greatest number of victims; and it is from such centres, also, that pestilence, having once obtained

[1] See vol. i., *Public Health Papers*, page 456.

a foothold, radiates in every direction, making havoc among the poor, and not always sparing the rich. In order successfully to combat with, or resist the invasion threatened by, any pestilence, we must secure to tenement populations the means of preserving to themselves a high degree of health, as well as a large percentage of life; for disease, when deprived of the strong advantage afforded by the average condition of tenement populations, will soon be reduced to diminutive proportions, as compared with the ordinary rates of sickness and mortality. The domiciles of tenement populations should be more commodious, dispersed over more extensive areas, and made to contain fewer families than those of ordinary structure. We should do away with the dark middle closets which are occupied as bedrooms, and have no direct communication to the external air, and throw them open to the genial influence of the sunlight, and to the purifying effects of an atmosphere rich in oxygen; for, without these invigorating influences, human life and health will never arrive at their maximum standard. Every facility for maintaining personal cleanliness should be provided; and the people should be thoroughly instructed in the application of this important sanitary measure; and if, added to these, we provide some means for social enjoyment, as a room set apart for that purpose in each tenement house, and furnished with reading matter, games, and other sources of innocent amusement, to which all should have a common right, we shall have contributed in no small degree towards elevating the standard of physical and moral health among tenement populations.

A REPORT ON THE DEATH-RATE OF EACH SEX IN MICHIGAN, AND A COMPARISON WITH DR. FARR'S LIFE TABLES OF HEALTHY DISTRICTS OF ENGLAND.

By HENRY B. BAKER, M. D.,

Secretary of the State Board of Health, and Registrar of Vital Statistics of Michigan.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 10, 1874.

In stating and comparing the total death-rate in Michigan, I do so by means of Life Tables, for the reason that I know of no other method whereby it can be properly stated or compared. We may say that the annual mortality is such a specified per cent. of the living inhabitants; but the population of our cities and States is far from a fixed one, and varies in each city, State, or country, and the death-rate depends so much upon the age and sex of the inhabitants that no very useful estimate of the healthfulness or unhealthfulness of a climate or locality can be formed from such imperfect data. It is requisite, first, to construct a Life Table, or to reduce the statement to one concerning a "fixed population," — that is, a population such as would be maintained in that locality by a specified, constant, and uniform birth-rate alone, without immigration or emigration.

Life Tables for the entire United States, constructed from the United States censuses, are almost necessarily to some extent "evolved from the inner consciousness" of those who construct them. This is so for the reason that it has not been possible to obtain reliable data which would enable one to make the necessary corrections for the omission of deaths in the enumeration. That this may not stand simply as an unsupported assertion, I wish to cite a few of the recognized authorities. Referring to this subject, the author of the Life Table in the United States Census volume for 1860 remarks: "Hence to know the true law of mortality, we must either await such progressive registration, or else resort to new methods of analysis and combination of the existing statistics, as here proposed." For the Life Table published in that volume the death-rate appears to have been established by first increasing the deaths returned by a constant factor, derived from the mind of the statistician, then separately modifying the death-rate of those aged under five years, of those aged 70 to 80 years, and of those aged 80 to 90 years, each by a different factor arrived at by estimates, apparently based upon the author's general knowledge of vital statistics.

For the Life Table published with the census of 1870, Mr. Elliott increased the deaths returned by 41 per cent., this being requisite to make the death-rate equal that in England and Wales. It may be objected that when this is done we do not learn anything concerning the real death-rate in the United States, for we have forced it to appear the same as already found to

be in some other country. Life Tables thus constructed must necessarily be very much like Life Tables in England and Wales. On this point Mr. Elliott remarks[1] that "It is impossible to determine with precision the amount of deficiency in the return of deaths, but from the results herein computed on the assumption of a deficiency of forty-one per cent., it is easy to calculate corresponding values which shall conform to the assumption of any other supposed rate of deficiency."

In the Insurance Report of Massachusetts for the year 1868, page 103, Mr. L. W. Meach published a Life Table for males in the United States, "upon the ample basis of thirty years' observations," which probably means that it was formed from the three United States Censuses of 1840, 1850, and 1860; but upon what plan the omissions in returns of deaths were estimated is not stated. Other Life Tables may have been published, but all that have come to the writer's notice have been mainly estimates, in the absence of exact evidence on the subject. General Walker, Superintendent of the Ninth United States Census, remarks that "The dimensions attained by the life insurance interest within the past few years make it peculiarly a matter of regret at the present time that the census should not afford the data for determining with absolute precision and certainty the death-rate of the country, whether in the aggregate, or by classes of the population." [2]

Inasmuch as no method has yet been found, or at least acted upon, whereby the actual death-rate can be positively ascertained for the United States, or, so far as I know, for any single State, I venture to offer these Life Tables for males and for females in Michigan, as tables based entirely upon evidence of the death-rate in the State, the corrections for omissions in enumerating being made upon a principle which does not appear to have been tried in any other locality. The principle upon which the correction is made may be stated briefly as follows: The number actually omitted because of a delay of a given time, as for instance of one year, is ascertained by comparing the results of two separate enumerations of the deaths in the same locality during the same time, one enumeration being made at one time by one set of officers, the other at a different time by a different set of officers. We thus find the proportion of deaths omitted after the lapse of a given time. It is assumed that the proportional number omitted is in proportion to the length of time which has passed since they occurred, and before their enumeration.

It is not possible to say that even if enumerated in the same months in which the deaths occurred none would be forgotten or overlooked; but for this, no correction has been proposed, and none is here offered. It is not probable that many would be omitted under such circumstances.

It is quite probable that some other modification may hereafter be discovered to be essential to perfect accuracy, but the writer believes that this method will be found to be adequate to the correction of at least the greater part of the error in the returns of deaths made after the close of the year in which the deaths occurred, as is the case at present in Michigan and in the enumeration for the United States Census.

[1] Page 10, Vital Stat. U. S. Census, 1870.

[2] Foot-note on page 9, Vital Stat. U. S. Census, 1870.

The results of this method of correction, which appear in this table for males and females, are based simply upon the evidence collected in one State, and in one year, — that of 1870. In order to render the evidence more reliable, observations must be extended through a long series of years. The death-rate in Michigan, so far as evidenced by the returns, was larger during the year 1870, than it usually is, the increased number of deaths being returned as caused by zymotic diseases. There were no very serious epidemics of small-pox, cholera, or other contagious diseases, except scarlatina, from which 852 deaths were returned. These tables do not therefore include those chances of death attendant upon serious epidemics.

The correction for omissions was made by comparing the returns for the census year as made by the registration officers with those of the census marshals, thus:

$$\overbrace{\underset{\text{Dec. 1869.}}{801} \;:\; \underset{\text{Jan. 1870.}}{800}}^{\text{Deaths by Census.}} \;::\; \overbrace{\underset{\text{Dec. 1869.}}{836} \;:\; \underset{\text{Jan. 1870.}}{\times}}^{\text{Deaths by Registration.}}$$

, whence $\times = 834$. The number actually returned for January, 1870, by the registration officers was 421; $834 - 421 = 413 = 98.09$ per cent. of the numbers returned. The deaths for December and January were enumerated by the census marshals about five months after they occurred; the deaths for December were enumerated by the registration officers after about four months, but the deaths for January were not enumerated by the registration officers until after a year and four months. This 98.09 per cent. was therefore added to the deaths for January, 1870, as a correction for omissions because of one year's additional time elapsing between the occurrence of the deaths and their enumeration. Upon evidence which seemed to warrant the assumption, it was assumed that if the lapse of one year's time resulted in omissions to such an extent that 98.09 per cent. of the deaths returned should be added to them to make them equal the deaths which would have been returned if enumerated in months of occurrence, then the lapse of one month's time would require the addition of one twelfth of that per cent. and the intermediate months in a corresponding proportion.

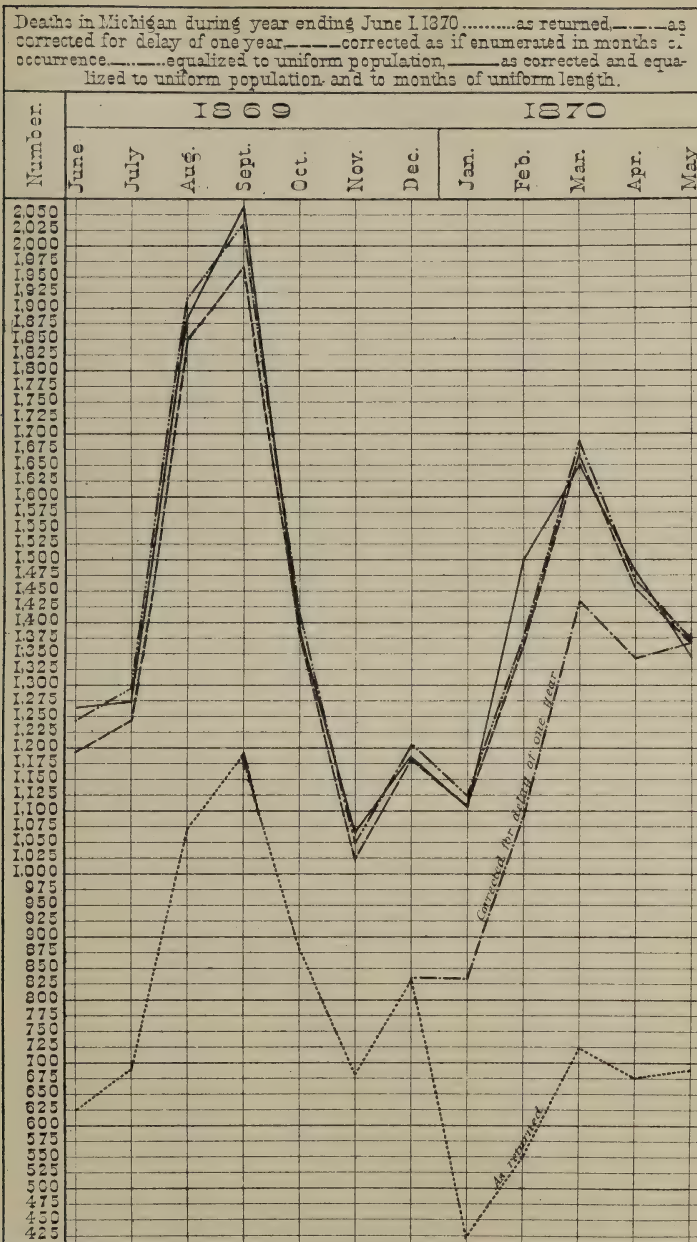
The methods and results of the corrections will be best explained by means of exhibits A and B, and diagrams 3 and 4, graphically representing the same.

EXHIBIT A. — *Exhibiting, by Months, and the Total Number for the Census Year ending June 1, 1870, the Deaths as returned by Registration Officers; the Number of Deaths for the Last Five Months of the Census Year, increased by an Estimated Correction for Omissions resulting from One Year Additional Time elapsing before Enumeration, — giving the Number as it would have been if enumerated in May, 1870, instead of May, 1871; the Number of Deaths for the Census Year, increased by an Estimated Correction for Omissions resulting from the Time elapsing before Enumeration, — giving the Number as it would have been if enumerated in Months of Occurrence; the Deaths so corrected, equalized to a Supposed Uniform Population equaling that at close of Year; and the Deaths thus corrected and equalized, equalized to Months of uniform length.*

	Total.	1869.							1870.				
		June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.
Deaths as returned by registration officers	9,040	630	687	1,068	1,194	874	686	836	421	553	724	678	689
Per cent. of deaths to be added for correction for one year additional time before enumeration . . .	......	......	......	......	......	......	......	......	98.09	98.09	98.09	98.09	98.09
Deaths, if enumerated in May, 1870, instead of May, 1871	6,071	......	......	......	......	......	......	......	834	1,095	1,434	1,343	1,365
Per cent. of deaths to be added for correction for time before enumeration	......	89.92	81.75	73.58	65.41	57.24	49.07	40.90	32.73	24.56	16.39	8.22	.00
Deaths corrected as if enumerated in months of occurrence	16,802	1,196	1,248	1,853	1,974	1,374	1,022	1,178	1,106	1,364	1,669	1,453	1,365
Deaths as corrected, equalized to population at close of year	17,187	1,246	1,296	1,918	2,036	1,413	1,047	1,203	1,125	1,383	1,687	1,463	1,370
Deaths corrected and equalized to months of uniform length	17,211	1,264	1,273	1,883	2,066	1,388	1,062	1,181	1,105	1,503	1,657	1,484	1,345

The first, third, fifth, sixth, and seventh lines in Exhibit A are graphically represented in Diagram No. 3. The first and last lines of Exhibits A and B are illustrated in Diagram No. 4.

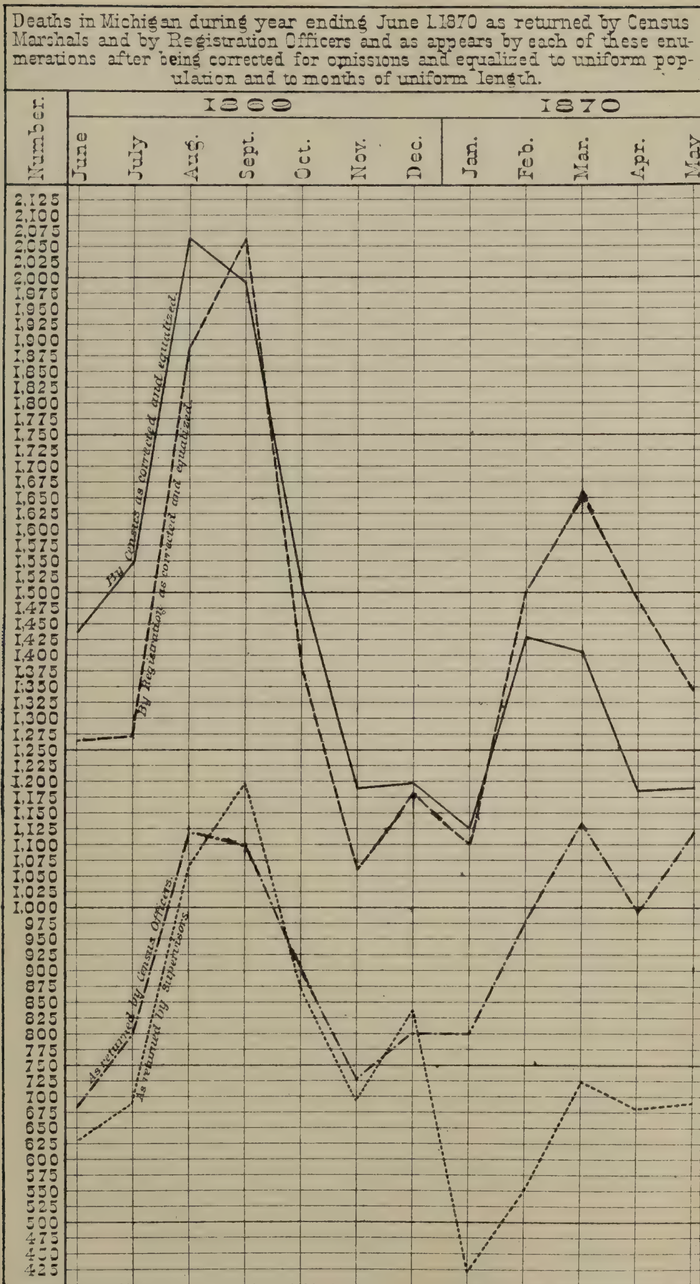
DIAGRAM Nº 3.



THE CALVERT LITH. CO. DETROIT.

Designed by H. B. Baker, M.D.

DIAGRAM Nº 4.



THE CALVERT LITH.CO.DETROIT.

Designed by H.B.Baker, M.D.

EXHIBIT B. — *By Months, the Number of Deaths in Michigan during the Census Year ending June* 1, 1870, *as returned by Census Officers; the Number, corrected by calculation, for time elapsing before Enumeration, — giving the calculated Number that would have been returned had they been enumerated in Months of occurrence; the Number Equalized to a supposed constant Population equaling the Population at the close of the Year; and the Number of Deaths, thus estimated, equalized to Months of uniform Length of* 30.44 *days.*

	Total.	1869.							1870.				
		June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.
Deaths, as returned by census officers, for census year	[1] 11,160	689	799	1,118	1,097	905	727	801	800	977	1,134	996	1,119
Per cent. of deaths to be added as a correction for time elapsing before enumeration	....	98.09	89.92	81.75	73.58	65.41	57.24	49.07	40.90	32.73	24.56	16.39	8.22
Number of deaths to be added for above correction	5,695	674	718	914	807	592	416	393	327	320	279	163	92
Deaths if enumerated in months of occurrence . .	16,855	1,361	1,517	2,032	1,904	1.497	1,143	1 194	1,127	1,297	1,413	1,159	1,211
Per cent. of deaths to be added to equalize them to population at close of year	....	4.21	3.86	3.51	3.16	2.81	2.46	2.11	1.76	1.41	1.06	.71	.35
Deaths to be added to equalize them to population at close of year	[2] 407	57	59	71	60	42	28	25	20	18	15	8	4
Deaths, as corrected, equalized to population at close of year	17,262	1,418	1,576	2,103	1,964	1,539	1,171	1,219	1,147	1,315	1,428	1,167	1,215
Days and hundredths by which the months should be increased or diminished to equalize them to uniform length	....	+.44	−.56	−.56	+.44	−.56	+.44	−.56	−.56	+2.44	−.56	.44	−.56
Number by which the deaths should be increased or diminished to equalize them to months of uniform length	+13	+21	−28	−38	+29	−28	+17	−22	−21	+114	−26	+17	−22
Deaths corrected and equalized, equalized to months of uniform length	17,275	1,439	1,548	2,065	1,993	1,511	1,188	1,197	1,126	1,429	1,402	1,184	1,193

[1] Excluding 22 in unknown month.

[2] Estimated population in 1869 was 1,131,600; in 1870, by same estimate, it was 1,184,672. Assuming the increase of population to have been the same in every month of the year, the average population in which the deaths were collected was 1,158,136. Then 1,158,136 : 16,855 : : 1,184,672 : x, whence x equals 17,241 : x — 16,855 = 386, — the number to be added to equalize to population June 1, 1870. The discrepancy between this and the result (407) is due to the fact that in this table the number of deaths in the months opposite which the greatest per cent. is placed chanced to be slightly larger than the average. It is as near as is practicable.

The omissions during the year ending *June* 1, 1870, appeared to be such that the deaths returned should be multiplied by 1.86 in order to equal the number which was believed to have occurred, but the deaths returned for the year ending *December* 31, 1870, corrected upon the same principle, it appears should only be multiplied by 1.79 in order to equal the true number. As the system of registration becomes more perfect, it is probable that the amount of the correction may be modified, and a mean of several years would approximate closer to the true statement. These life tables are made by using the decimal 1.86 with which to multiply the deaths returned, that being the first result of a direct comparison and correction in this manner. It is possible that it may increase the number of deaths slightly more than should be done. For the year for which the tables are made, deaths were also returned in greater number than for the year preceding or succeeding. On the other hand, no very extraordinary epidemic prevailed. The correction is only claimed to make the deaths equal the number which would have been returned if enumerated in the months when they occurred.

In constructing these life tables for Michigan, the population represented by deaths was equalized throughout all ages before computing the death-rate, which was computed for each and every age, in order that if any real "climacteria" exist they might be discovered. Climacteria cannot well be discovered when the death-rate is computed by periods of ten years. If the death-rate is computed by periods of five years, every alternate period will contain the important even year — such as twenty, thirty, forty, fifty, etc. — and the death-rate for that period will appear too small, because the number of inhabitants stated in the census as living at such ages is always too large. The statement of the age of persons who have died is much more accurate than the statement of the age of the living. By equalizing the population *before* computing the death-rate, we may avoid equalizing the deaths, and leave them free to exhibit at each and every age any variation which may occur.

It may be proper in this connection to call attention to the fact that the life table for females in Michigan, does not show any extraordinary increase of the death-rate of women aged forty to fifty years as compared with the males of the same ages; on the contrary for about all ages over that of fifty years, the death-rate of males exceeds that of females. It increases somewhat rapidly, however, for both sexes, at about that age.

The essential columns of these life tables are here presented.

TABLE I. — *Exhibiting the essential parts of Life Tables for each sex in Michigan, stating, for each age, the Chances of Death for one thousand persons living at that age, the Average Future Duration of Life, the Probable Future Duration of Life, and the Probable Age at Death.*

Age in Years.	Deaths to one thousand living.		Mean after Lifetime at each Age.[1]		True Expectation of Life (Probable Life).		Probable Age at Death.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
0	169.1	135.0	43.79	44.24	53.05	49.52	53.05	49.52
1	56.2	47.8	51.61	50.07	60.48	58.14	61.48	59.14
2	29.8	25.4	53.65	51.56	61.23	59.93	63.23	61.93
3	22.7	18.8	54.28	51.89	61.24	59.91	64.24	62.91
4	14.0	13.5	54.53	51.87	60.91	59.58	64.91	63.58
5	11.7	11.8	54.30	51.58	60.24	59.03	65.24	64.03
6	8.5	10.7	53.94	51.19	59.48	58.30	65.48	64.30
7	5.9	7.4	53.39	50.73	58.66	57.56	65.66	64.56
8	6.7	6.6	52.71	50.11	57.78	56.73	65.78	64.73
9	5.4	6.6	52.06	49.44	56.92	55.88	65.92	64.88
10	5.6	4.5	51.34	48.76	56.04	55.31	66.04	65.31
11	4.0	4.8	50.63	47.98	55.18	54.17	66.18	65.17
12	5.2	5.3	49.83	47.21	54.29	53.31	66.29	65.31
13	4.0	6.3	49.09	46.46	53.42	52.46	66.42	65.46
14	4.1	5.6	48.28	45.75	52.52	51.65	66.52	65.65
15	3.9	8.8	47.48	45.01	51.63	50.81	66.63	65.81
16	4.2	7.5	46.66	44.40	50.73	50.06	66.73	66.06
17	5.7	9.4	45.86	43.73	49.83	49.29	66.83	66.29
18	4.7	8.7	45.12	43.14	48.98	48.58	66.98	66.58
19	8.8	11.7	44.33	42.52	48.10	47.84	67.10	66.84
20	6.9	8.8	43.72	42.02	47.32	47.16	67.32	67.16
21	10.5	8.4	43.02	41.38	46.49	46.38	67.49	67.38
22	7.3	12.7	42.47	40.73	45.75	45.58	67.75	67.58
23	7.8	8.1	41.78	40.25	44.93	44.89	67.93	67.89
24	6.6	11.2	41.10	39.57	44.20	44.08	68.20	68.08
25	6.1	9.3	40.37	39.02	43.46	43.32	68.46	68.32
26	6 9	10.8	39.62	38.38	42.70	42.52	68.70	68.52
27	6.4	11.1	38.89	37.79	41.97	41.75	68.97	68.75
28	6.7	12.5	38.14	37.21	41.14	40.98	69.14	68.98
29	6.3	8.9	37.39	36.67	40.30	40.29	69.30	69.29
30	5.9	11.4	36.62	36.00	39.45	39.51	69.45	69.51
31	6.3	9.4	35.84	35.41	38.59	38.78	69.59	69.78
32	8.9	18.3	35.06	34.74	37.73	38.00	69.73	70.00
33	7.1	8.4	34.37	34.38	36.94	37.34	69.94	70.34
34	6.2	11.6	33.61	33.66	36.07	36.50	70.07	70.50
35	8.2	15.8	32.82	33.05	35.15	35.70	70.15	70.70
36	6.1	9.1	32.09	32.58	34.27	34.99	70.27	70.99
37	6.3	11.4	31.28	31.87	33.36	34.16	70.36	71.16
38	10.0	13.6	30.48	31.23	32.45	33.38	70.45	71.38
39	6.3	10.5	29.78	30.66	31.59	32.64	70.59	71.64
40	9.2	8.2	28.96	29.98	30.67	31.83	70.67	71.83
41	6.4	8.1	28.23	29.22	29.80	30.99	70.80	71.99
42	9 3	13.7	27.41	28.46	28.89	30.12	70.89	72.12
43	10.8	11.4	26.66	27.84	28.01	29.35	71.01	72.35
44	11.5	10.4	25.95	27.16	27.18	28.53	71.18	72.53
45	11.0	11.2	25.24	26.44	26.36	27.70	71.36	72.70
46	11.0	6.3	24.52	25.73	25.53	26.88	71.53	72.88
47	8.5	11.5	23.78	24.89	24.70	25.98	71.70	72.98
48	10.3	14.7	22.98	24.18	23.82	25.15	71.82	73.15
49	12.6	11.5	22.22	23.53	22.98	24.36	71.98	73.36
50	17.5	16.6	21.50	22.80	22.13	23.53	72.13	73.53
51	12.4	9.1	20.87	22.17	21.33	22.76	72.33	73.76
52	18.5	14.5	20.12	21.37	20.47	21.89	72.47	73.89
53	15.3	14.8	19.49	20.68	19.68	21.08	72.68	74.08

[1] Average Future Duration of Life, so-called "Expectation of Life."

TABLE 1. — *Life Table for Michigan, Continued.*

Age in Years.	Deaths to one thousand living.		Mean after Lifetime at each Age.[1]		True Expectation of Life (Probable Life).		Probable Age at Death.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
54	17.8	13.2	18.79	19.98	18.85	20.26	72.85	74.26
55	22.1	17.2	18.12	19.24	18.06	19.42	73.06	74.42
56	19.5	20.5	17.52	18.57	17.37	18.62	73.37	74.62
57	29.2	18.0	16.86	17.95	16.64	17.85	73.64	74.85
58	25.0	12.3	16.35	17.27	16.04	17.07	74.04	75.07
59	19.2	15.0	15.76	16.48	15.39	16.22	74.39	75.22
60	24.2	20.1	15.06	15.72	14.65	15.41	74.65	75.41
61	24.3	16.7	14.42	15.04	13.97	14.67	74.97	75.67
62	37.9	26.6	13.76	14.28	13.28	13.87	75.28	75.87
63	28.3	28.4	13.29	13.66	12.74	13.15	75.74	76.15
64	33.3	42.5	1266	13.04	12.07	12.42	76.07	76.42
65	47.0	34.0	1208	12.60	11.39	11.80	76.39	76.80
66	38.3	32.7	11.65	12.03	10.84	11.12	76.84	77.12
67	39.6	40.1	11.09	11.42	10.18	10.46	77.18	77.46
68	24.9	45.9	10.53	10.87	9.51	9.86	77.51	77.86
69	41.7	40.6	9.79	10.37	8.71	9.26	77.71	78.26
70	69.3	54.0	9.19	9.79	8.04	8.59	78.04	78.59
71	63.8	51.7	8.84	9.32	7.70	8.00	78.70	79.00
72	85.3	60.3	8.41	8.80	7.25	7.44	79.25	79.44
73	70.1	67.9	8.15	8.33	6.92	6.92	79.92	79.92
74	71.8	82.3	7.72	7.90	6.48	6.47	80.48	80.47
75	79.7	77.5	7.28	7.57	6.02	6.11	81.02	81.11
76	101.0	105.1	6.87	7.16	5.63	5.71	81.63	81.71
77	117.4	96.0	6.58	6.94	5.36	5.51	82.36	82.51
78	105.3	120.7	6.40	6.63	5.16	5.20	83.16	83.20
79	122.6	118.3	6.09	6.47	4.87	5.06	83.87	84.06
80	126.0	123.1	5.87	6.27	4.66	4.89	84.66	84.89
81	129.4	127.9	5.65	6.08	4.44	4.72	85.44	85.72
82	142.8	132.7	5.41	5.89	4.23	4.57	86.23	86.57
83	145.2	137.5	5.23	5.72	4.09	4.42	87.09	87.42
84	157.0	142.3	5.04	5.55	3.93	4.26	87.93	88.26
85	159.1	147.1	4.88	5.39	3.80	4.13	88.80	89.13
86	161.2	151.9	4.71	5.24	3.64	4.00	89.64	90.00
87	171.0	156.7	4.52	5.09	3.46	3.89	90.46	90.87
88	180.8	161.5	4.35	4.94	3.30	3.77	91.30	91.77
89	190.6	166.3	4.21	4.79	3.16	3.65	92.16	92.65
90	197.1	171.6	4.08	4.65	3.05	3.54	93.05	93.54
91	203.5	177.5	3.96	4.51	2.95	3.42	93.95	94.42
92	210.0	183.4	3.85	4.37	2.86	3.31	94.86	95.31
93	216.5	189.3	3.74	4.24	2.78	3.20	95.78	96.20
94	223.0	195.2	3.63	4.12	2.70	3.09	96.70	97.09
95	229.5	201.1	3.53	3.99	2.63	2.99	97.63	97.99
96	235.9	207.0	3.43	3.87	2.55	2.91	98.55	98.91
97	242.4	212.9	3.34	3.75	2.48	2.84	99.48	99.84
98	248.9	218.8	3.25	3.63	2.40	2.76	100.40	100.76
99	255.4	224.7	3.17	3.50	2.34	2.68	101.34	101.68
100	261.9	230.6	3.09	3.37	2.29	2.61	102.29	102.61
101	268.3	236.5	3.00	3.23	2.23	2.54	103.23	103.54
102	274.8	242.4	2.91	3.08	2.20	2.49	104.49	104.49
103	281.3	248.3	2.81	2.90	2.07	2.43	105.07	105.43
104	287.8	254.2	2.70	2.69	2.00	2.38	106.00	106.38
105	294.3	260.1	2.62	2.43	2.00	2.33	107.00	107.33
106	300.7	266.0	2.50	2.11	2.00	2.16	108.00	108.16
107	307.2	271.9	2.33	1.67	2.00	1.61	109.00	108.61
108	313.7	514.6	2.08	1.09	2.00	.95	110.00	108 95
109	320.2	757.3	1.75	.75	1.67	.67	110.67	109.67
110	326.7	1000.0	1.37	.50	1.33	.50	111.33	110.50
111	663.3	–	.90	–	1.00	–	112.00	–
112	1000.0	–	.50	–	.50	–	112.50	–

[1] Average Future Duration of Life, so-called "Expectation of Life."

TABLE 2. — *Exhibiting the essential parts of Life Tables, for each Sex, in the Healthy Districts of England, stating the Chances of Death for one thousand persons living at each age, the Average Future Duration of Life at every fifth age, the Probable Future Duration of Life at each age, and the Probable Age at Death.*

Age in Years.	Deaths to one thousand living.[1]		Mean after Lifetime at each age.[2]		True Expectation of Life (Probable Life.)[1]		Probable Age at Death.[1]	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
0	112.8	92.6	48.56	49.45	58.55	59.24	58.55	59.24
1	35.1	31.9	–	–	62.32	62.26	63.32	63.26
2	21.8	21.7	–	–	62.41	62.34	64.41	64.34
3	15.4	15.3	–	–	62.04	62.02	65.04	65.04
4	12.6	12.5	–	–	61.46	61.48	65.46	65.48
5	10.3	10.3	54.39	53.93	60.80	60.84	65.80	65.84
6	8.3	8.4	–	–	60.06	60.13	66.06	66.13
7	6.7	7.0	–	–	59.24	59.36	66.24	66.36
8	5.5	5.9	–	–	58.39	58.55	66.39	66.55
9	4.6	5.2	–	–	57.51	57.71	66.51	66.71
10	4.0	4.7	51.28	50.88	56.61	56.84	66.61	66.84
11	3.6	4.5	–	–	55.70	55.97	66.70	66.97
12	3.6	4.5	–	–	54.78	55.08	66.78	67.08
13	3.6	4.7	–	–	53.86	54.20	66.86	67.20
14	3.9	5.1	–	–	53.05	53.32	67.05	67.32
15	4.3	5.5	47.20	47.04	52.13	52.44	67.13	67.44
16	4.7	6.0	–	–	51.23	51.58	67.23	67.58
17	5.2	6.5	–	–	50.34	50.72	67.34	67.72
18	5.8	6.9	–	–	49.46	49.88	67.46	67.88
19	6.4	7.4	–	–	48.59	49.05	67.59	68.05
20	7.0	7.7	43.40	43.50	47.74	48.22	67.74	68.22
21	7.1	7.9	–	–	46.89	47.40	67.89	68.40
22	7.3	8.0	–	–	46.05	46.57	68.05	68.57
23	7.5	8.1	–	–	45.20	45.76	68.20	68.76
24	7.6	8.3	–	–	44.36	44.94	68.36	68.94
25	7.8	8.4	39.93	40.18	43.52	44.12	68.52	69.12
26	7.8	8.5	–	–	42.68	43.30	68.68	69.30
27	7.9	8.6	–	–	41.84	42.48	68.84	69.48
28	8.0	8.8	–	–	41.00	41.66	69.00	69.66
29	8.1	8.8	–	–	40.16	40.84	69.16	69.84
30	8.2	8.9	36.45	36.85	39.31	40.02	69.31	70.02
31	8.3	9.0	–	–	38.47	39.20	69.47	70.20
32	8.3	9.1	–	–	37.63	38.37	69.63	70.37
33	8.4	9.2	–	–	36.79	37.55	69.79	70.55
34	8.5	9.3	–	–	35.94	36.73	69.94	70.73
35	8.7	9.4	32.90	33.46	35.10	35.90	70.10	70.90
36	8.8	9.5	–	–	34.25	35.08	70.25	71.08
37	8.9	9.7	–	–	33.41	34.25	70.41	71.25
38	9.0	9.8	–	–	32.57	33.42	70.57	71.42
39	9.2	9.9	–	–	31.72	32.59	70.72	71.59
40	9.6	10.0	29.29	30.00	31.19	31.77	71.19	71.77
41	9.6	10.2	–	–	30.04	30.94	71.04	71.94
42	9.8	10.3	–	–	29.20	30.11	71.20	72.11
43	10.1	10.5	–	–	28.36	29.28	71.36	72.28
44	10.4	10.7	–	–	27.52	28.45	71.52	72.45
45	10.8	10.9	25.65	26.46	26.69	27.63	71.69	72.63
46	11.1	11.1	–	–	25.86	26.80	71.86	72.80
47	11.5	11.4	–	–	25.03	25.98	72.03	72.98
48	12.0	11.6	–	–	24.21	25.15	72.21	73.15
49	12.5	11.9	–	–	23.39	24.33	72.39	73.33

[1] Computed from Dr. Farr's Life Tables.

[2] Average Future Duration of Life, so-called "Expectation of Life." Taken from Dr. Farr's *Life Tables for Healthy Districts.* Quoted from Walford's *Insurance Cyclopædia.*

TABLE 2. — *For Healthy Districts of England, Continued.*

Age in Years.	Deaths to one thousand living.[1]		Mean after Lifetime at each age.[2]		True Expectation of Life (Probable Life.)[1]		Probable Age at Death.[1]	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
50	13.0	12.2	22.03	22.87	22.58	23.51	72.58	73.51
51	13.6	12.5	–	–	21.77	22.69	72.77	73.69
52	14.2	12.9	–	–	20.96	21.87	72.96	73.87
53	14.9	13.3	–	–	20.16	21.06	73.16	74.06
54	15.7	13.7	–	–	19.37	20.24	73.37	74.24
55	16.5	14.1	18.45	19.24	18.59	19.43	73.59	74.43
56	17.4	14.2	–	–	17.81	18.63	73.81	74.63
57	18.3	16.2	–	–	17.04	17.82	74.04	74.82
58	19.4	18.2	–	–	16.28	17.04	74.28	75.04
59	21.4	20.3	–	–	15.52	16.27	74.52	75.27
60	23.7	22.3	15.06	15.69	14.79	15.53	74.79	75.53
61	26.1	24.4	–	–	14.07	14.81	75.07	75.81
62	28.5	26.5	–	–	13.38	14.10	75.38	76.10
63	31.1	28.8	–	–	12.71	13.42	75.71	76.42
64	33.9	31.2	–	–	12.06	12.75	76.06	76.75
65	36.8	33.9	12.00	12.58	11.43	12.10	76.43	77.10
66	44.8	36.7	–	–	10.82	11.47	76.82	77.47
67	43.4	39.7	–	–	10.23	10.85	77.23	77.85
68	47.2	43.1	–	–	9.66	10.26	77.66	78.26
69	51.2	46.8	–	–	9.11	9.68	78.11	78.68
70	55.6	50.8	9.37	9.85	8.58	9.12	78.58	79.12
71	60.4	55.2	–	–	8.07	8.59	79.07	79.59
72	65.7	60.0	–	–	7.59	8.08	79.59	80.08
73	71.3	65.2	–	–	7.13	7.59	80.13	80.59
74	77.4	71.0	–	–	6.69	7.12	80.69	81.12
75	84.0	77.2	7.15	7.52	6.27	6.67	81.27	81.67
76	91.1	83.9	–	–	5.87	6.25	81.87	82.25
77	98.6	91.1	–	–	5.50	5.84	82.50	82.84
78	106.9	99.0	–	–	5.14	5.47	83.14	83.47
79	115.5	107.3	–	–	4.81	5.10	83.81	84.10
80	124.9	116.2	5.37	5.64	4.50	4.77	84.50	84.77
81	134.7	125.8	–	–	4.20	4.46	85.20	85.46
82	145.2	135.9	–	–	3.93	4.16	85.93	86.16
83	156.4	146.9	–	–	3.68	3.88	86.68	86.88
84	167.9	158.1	–	–	3.44	3.63	87.44	87.63
85	180.2	173.0	4.01	4.19	3.21	3.39	88.21	88.39
86	193.4	182.9	–	–	2.99	3.16	88.99	89.16
87	206.5	196.5	–	–	2.81	2.95	89.81	89.95
88	220.8	210.0	–	–	2.64	2.77	90.64	90.77
89	235.6	224.5	–	–	2.48	2.59	91.48	91.59
90	250.7	240.3	2.99	3.11	2.32	2.43	92.32	92.43
91	265.6	254.8	–	–	2.17	2.27	93.17	93.27
92	281.9	272.1	–	–	2.01	2.12	94.01	94.12
93	301.2	287.7	–	–	1.90	1.97	94.90	94.97
94	314.5	307.7	–	–	1.81	1.86	95.81	95.86
95	335.1	321.4	2.25	2.32	1.71	1.76	96.71	96.76
96	348.8	345.0	–	–	1.63	1.66	97.63	97.66
97	369.0	357.1	–	–	1.52	1.59	98.52	98.59
98	396.2	375.0	–	–	1.42	1.50	99.42	99.50
99	406.2	400.0	–	–	1.38	1.41	100.38	100.41
100	421.1	407.4	1.69	1.75	1.30	1.36	101.30	101.36
101	454.5	437.5	–	–	1.17	1.25	102.17	102.25
102	500.0	444.4	–	–	1.00	1.17	103.00	103.17
103	333.3	600.0	–	–	1.50	.83	104.50	103.83
104	500.0	500.0	–	–	1.00	1.00	105.00	105.00
105	1000.0	–	–	–	.50	1.50	105.50	106.50
106	–	1000.0	–	–	–	.50	–	106.50

[1] Computed from Dr. Farr's Life Tables.

[2] Average Future Duration of Life, so-called "Expectation of Life." Taken from Dr. Farr's *Life Tables for Healthy Districts*. Quoted from Walford's *Insurance Cyclopædia*.

After making the most that could conveniently be made of the evidence to be obtained in Michigan, it became desirable to bring external evidence to bear upon the result. In looking about for some proper standard of comparison, the Life Tables constructed by Dr. Farr for the "healthy districts" of England have been selected, for several reasons: the two localities are not very dissimilar as regards average temperature, moisture of the atmosphere, etc.; both are nearly surrounded by water, the inhabitants of the two localities number about the same, and although there are many points of contrast, these "healthy districts" of England bear quite a close relation to Michigan as regards conditions affecting life and health. Finally, it is about the only locality of which I have seen Life Tables which seem worthy of confidence as approximate statements. Life Tables of insured persons can be more easily secured; but comparisons therewith cannot be undertaken here, however interesting they may prove to be.

As regards the selection of these "Healthy Districts of England," Dr. Farr says:—

"We have no means of ascertaining what the rate of mortality would be among men living in the most favorable sanitary conditions: otherwise observations for a term of years on a considerable number of such persons would supply a standard rate with which other rates could be compared. In the absence of such a standard, the districts of England in which the mortality rate did not exceed 17 annual deaths in 1,000 living have been selected as the basis of a new Life Table.[1]

"For the sake of convenience, these were called 'healthy districts,' consisting of sixty-four, or nearly a tenth part of the total registered districts of England and Wales, and inhabited by nearly a *million* of people. *Sixty-three* of these districts have been taken as the basis of the new Life Table."[2]

It is not claimed that we have gained a knowledge of the rate of mortality among persons living under the most favorable sanitary conditions. On this point Dr. Simon, in the First Report to the Privy Council, said: "In conclusion, I beg to observe that even in the very districts to which, provisionally, I refer as standards of health, there are deaths of a preventable kind; not many, indeed, but enough to satisfy your lordships that the healthiness of those districts, as compared with perfection, is but of moderate excellence; and enough to show that, if in those districts the population had exhausted all known means for removing the causes of disease, their death-rate would have contrasted still more strikingly with that of the unhealthier districts."[3]

The results of a comparison of the two Life Tables are best shown by means of diagrams. Diagram No. 1 exhibits, by numbers down from the top, and stated at left side, the deaths in 1,000 persons of each sex, at each age, in Michigan, and in the "healthy districts" of England. It will be seen that the several lines representing these four classes of persons bear a very

[1] William Farr, M. D., F. R. S., *Annual Report of Registrar General*, 1859, p. 174. Walford's *Insurance Cyclopædia*, vol. ii., p. 538.

[2] Dr. Farr, *Philosophical Transactions for* 1860; *Assurance Magazine*, vol. ix., p. 121; Walford's *Insurance Cyclopædia*, vol. ii., p. 539.

[3] Dr. Simon, in *First Report to the Privy Council*, 1859; Walford's *Cyclopædia of Insurance*, p. 540.

DIAGRAM No. 1.—Number of each sex in Mich., and in Healthy Districts of England, cut off by Death in 1,000 persons, at each Age.

——— =*Males in Mich.* ....=*Females in Mich.* - - - - - - =*Males in Healthy Districts of England.* —·—·— =*Females in Healthy Districts of England.*

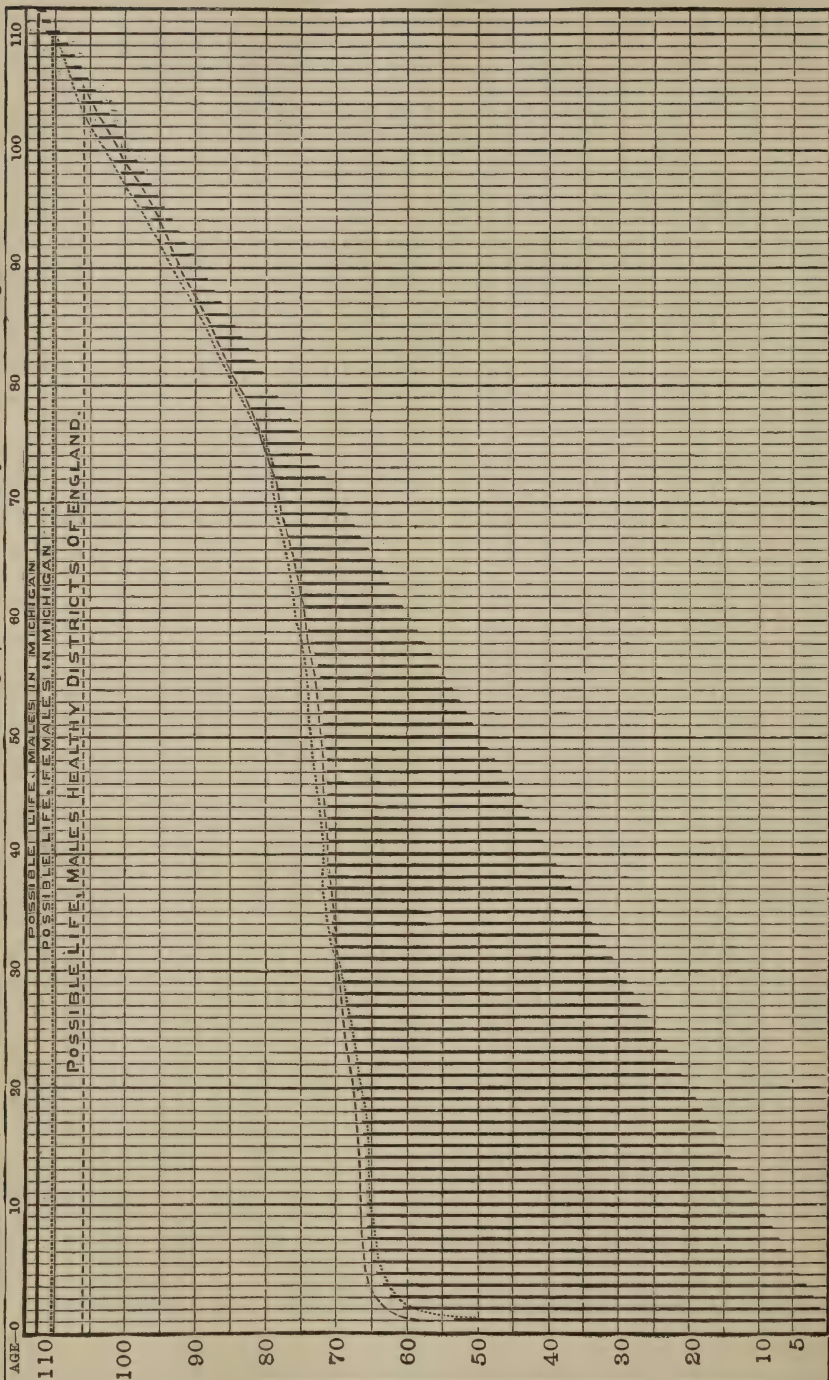
Drawn by Henry A. Haigh. MICHIGAN ENGRAVING CO., DETROIT, MICH. Designed by Henry B. Baker, M. D.

close resemblance at all ages until that of eighty years is reached, when the lines for England fall below those for Michigan, indicating, according to the data used, a higher death-rate at the older ages in England than in Michigan. The slightly greater death-rate in Michigan of those under one year of age may be explained by the fact that in Michigan still-births are included, but this will not explain the slightly greater death-rate at other ages under five years.

Diagram No. 2 exhibits graphically the probable duration of life of males in Michigan; and, by means of lines marking the upper limit of the probable life of females in Michigan and of males in the "healthy districts" of England, the close correspondence therewith is rendered apparent. At the top of the diagram is also exhibited the limit of "Possible Life." The heavy straight line at the top of the diagram is the limit of possible life of males in Michigan, — at the age of 112 years. The dotted straight line near the top of the diagram is the limit of possible life of females in Michigan, — 110 years. The dashed straight line near the top of the diagram is the limit of the possible life of males in the "healthy districts" of England, — 105 years. A corresponding line showing the limit of possible life for females is not drawn, as it would fall so near the line for males as not to be noticeable, — 106 years. The heavy vertical lines represent the probable life of males in Michigan. The bottoms of these lines begin at each succeeding age, from birth to 112 years. The tops of the lines are opposite the probable age at death, shown in the column on the left. As the diagram is drawn to scale, the probable duration of life is shown for each age by the length of the heavy vertical line. The dotted line, running near the tops of the vertical lines, represents the limit of probable life for females in Michigan, and the line of dashes shows the limit of probable life of males in the "healthy districts" of England. The corresponding line for females runs so near to this that it cannot well be drawn. The starting-point for each sex in each country is the same as for the males in Michigan; namely, opposite each particular year of age, shown on the left of the diagram for every decennial year.

One of the objects in view in preparing Diagram No. 2 was to enable those who examine it most easily to appreciate the very great difference between the "Probable Life" and the "Possible Life" at each and every age. This diagram relates to the "Healthy Districts" of England and to the healthful State of Michigan, and it will be seen by the line referring to Michigan, in this diagram, that except for the ages between one and twenty-five years, man does not live out one half of his "possible" time; and of the males in England only those aged under thirty-six years live out one half their "possible time." The total death-rate appears to be about the same in the two localities. The difference in this statement in the ages, — twenty-five in Michigan and thirty-six years in England, is caused by the shorter possible time in England, the time of which is stated as 105, whereas in Michigan it is believed to be not less than 112 years.

DIAGRAM No. 2.— Probable and Possible Life in Michigan, and in Healthy Districts of England.



The heavy vertical lines represent probable life of males, and dotted line near their tops marks the limit of probable life of females in Michigan. The dashed line shows same for males in Healthy District of England.

Drawn by Henry A. Haigh. Michigan Engraving Co., Detroit, Mich. Designed by Henry B. Baker, M. D.

INFANT MORTALITY IN THE STATE OF MICHIGAN.

BY H. B. BAKER, M. D.

Secretary State Board of Health and Superintendent of Vital Statistics of Michigan.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

These statements are worked out from my "Life Tables" for this State, and are believed to be as near the truth as it is practicable to attain at this time.[1] Quite different statements would appear if there were an attempt to make them from the per cent. of deaths under five to deaths at all ages. Perhaps this might properly be done if the population of the State was a "fixed" population, such as would be maintained by the birth-rate, and controlled by the death-rate which prevails in this State, but the actual population differs from such a "fixed population" by containing a larger proportion of children under five years of age. In such a "fixed population," as computed from my Life Tables for this State, the proportion of persons living aged under five years, to the total number at all ages, is as follows: males, 9.30; females, 9.56 per cent. By the census of 1874, it appears that in the actual population the proportion is as follows: males, 13.24; females, 14.05 per cent. The per cent. of deaths under five to total deaths is consequently larger than it would be if the population was fixed at that which would be controlled by the death-rate in this State, without modification by immigration or emigration. For the year 1872 the per cent. of deaths of those under one year of age to the total deaths was: males, 25.42; females, 23.17; of deaths of those aged under five years to total deaths it was: males, 42.44; females, 40.30.

"*What causes are contributing most to infant mortality?* (7)" — So far as relates to causes specified in the returns, they are in the order named, Scarlet Fever, Diarrhœa, Cholera Infantum, Pneumonia, and Dysentery. For the year 1873, the deaths reported from these diseases, of those aged under five years, were for each disease in the order named above: 361, 326, 302, 258, and 252. If the deaths from Diarrhœa, Cholera Infantum, and Dysentery be grouped together, and the deaths from "Bowel Diseases" be added, the aggregate number is indeed large. There is not much difficulty in fixing the actual cause of the excessive mortality from these specified causes among the conditions connected with the hot season of the year. It is also reasonably certain that the mortality from these causes is greater in cities and villages than in rural districts. I have no hesitation in subscribing to the belief that much of this infant mortality could be prevented by thorough and

[1] The questions to which the writer here attempts to reply were submitted to him by the Secretary of the Public Health Association in the following terms: —

"*Infant Mortality.* — What percentage of all infants born alive in your community survive to their first birth-day?" (*Ans.* — I reply that for this State, including still-births, it is: males, 83.09 per cent.; females, 86.50 per cent. Concerning those born alive, I have made no special computation.)

"What per cent. survive to the fifth?" (*Ans.* — Including still-births, 73.32 per cent. of the males, and 77.70 per cent. of the females born survive to their fifth birth-day.)

enlightened action by local boards of health in cities and villages. Much more might be prevented if the parents, in all parts of the State, were well informed as to the *causes* of infant mortality. To collect and disseminate information on such subjects is the function of the State Board of Health. For this work "Vital Statistics" are essential; and although the system of registration and report of vital statistics is somewhat new in this State, much information of great value has already been collected upon this subject; and it is hoped that the time is not far distant when the State Board of Health, already established in this State, can disseminate among the people such information on this subject as will tend to lessen the infant mortality in proportion as its warnings are heeded by the people.

Inflammation of the lungs is one of the prominent causes of infant mortality in this State. As to the actual cause of this disease, if the evidence already collected in the vital statistics of this State shall be verified by further examination, much of the infant mortality from this cause may be prevented by intelligent action of those who may control the condition of the air in dwellings and schools, as regards purity and humidity, but more especially as regards the warmth and humidity of the atmosphere in the sleeping-rooms of the children. The greatest number of deaths from this disease seems to occur in a cold and dry atmosphere.

In my first reply to the question "(7)," the deaths from scarlet fever were stated for the year 1873. From this disease, deaths had previously been reported of those aged under five years as follows: in 1869, 163 deaths; in 1870, 531 deaths; in 1871, 408 deaths; in 1872, 336 deaths. It will be seen that this is one of the important causes of infant mortality in this State. In my opinion a very considerable proportion of the deaths from this cause might be prevented, and will be prevented, as soon as the people will act upon the instructions of the State Board of Health. It will take some time, however, for this influence to permeate the whole people sufficiently to result in uniform, prompt, and efficient action for the accomplishment of this result. My belief in the preventability of much of the mortality from scarlet fever is based in part upon the belief that the disease is less fatal among persons who have passed the age of five or six years. Unfortunately we have not yet such records of cases of the disease in this State as will enable one to verify or disprove this belief. If it is true, then prompt isolation of first cases, and thorough destruction of the contagium, will result in saving the lives of many, by postponing the time when the disease shall be contracted. But whether the mortality is or is not less after the infantile period, many lives may be saved by the means suggested; for to some thus shielded in infancy the contagium may never again come in sufficient force to cause the disease. It seems probable that, even with no systematic effort for that purpose, many persons now pass through life without ever having the disease. It is the solemn duty of local boards of health to largely increase this number. I regard the great slaughter of the innocents in this State, by this disease, as a stinging reproach to the local boards of health for their inefficiency, and a powerful argument for the need of a State Board of Health, charged with the noble duty of educating the people in the way of life.

THE INFLUENCE OF THE HIGH ALTITUDES AND CLIMATE OF THE TABLE LAND COUNTRY OF THE ROCKY MOUNTAIN REGION UPON HEALTH AND DISEASE.

BY B. E. FRYER, M. D.,

Assistant Surgeon United States Army.

READ AT ANNUAL MEETING, PHILADELPHIA, NOVEMBER 12, 1874.

THAT climate generally, as to its effect on man in health and disease, is a matter but yet imperfectly and differently understood, cannot, we think, be denied; while exact knowledge and definite conclusions derived therefrom are of the utmost interest, and very much to be desired. If this be true of the climatic effect generally, as far as exact information is concerned, it is the more certainly so of that portion of our own territory known as the great table land country of the Rocky Mountain region, published observation on which, while so desirable, is even more limited and necessarily more unsatisfactory than that of many other parts of our territory.

The following entirely practical remarks which have of necessity been but hurriedly thrown together in the midst of many interruptions, are made up from the outlines of observations made in portions of this table land country during a five years' tour of duty there. It is hoped that they may be the means, by calling attention to the matter, of inducing others to observe and record more fully their work of observation, so that the climate of this region may be the more exactly known to us, and its effects the more definitely understood and appreciated. If this plateau has good or ill effect on our race in health, we should be able to show it; if its climate has any advantages for a reference to it of some of our chronic diseases, it should be understood exactly in what kind of cases it may be applied; if it has injury for certain affections in some of their stages, this should be pointed out. To these determinations we hope to contribute somewhat.

From the district included sometimes in the table land region we may well eliminate all where an altitude of less than twelve hundred feet above the sea level obtains, and the eastern limit for observation, therefore, might be placed by a north and south line which would run through Central Kansas, where the elevation will average 500 feet. The ascent westward from this line to the Rocky Mountains is gradual but steady, until at *their* base we find a height on the level often of more than 7,000 feet above the sea. Our observations will be confined to this eastward slope from the mountains to the altitude first named, and in the main to its southern portion.

We will first call attention very briefly to the physical appearance of the plateau country, give an outline account of it meteorologically, and then consider the climatic effect both as to health and disease.

Even the more level portions of our plateau — the so-called great plains — which begin in Kansas about one hundred miles west of the Missouri River, and extend to the western part of Eastern Colorado, are, contrary to what is generally believed, far from being free from well-marked undulations; and we have over the larger extent of these plains, elevations and depressions which interfere with having a large part of the territory under our eye at any one time, and though while from the hills of the more rolling regions of prairie we can of course see farthest, still even there we can seldom get any very extensive view until we approach the greater altitudes, when the mountains become visible and their sides can be seen at a distance from them of over a hundred miles.

Over the larger extent of the plains we notice the almost entire absence of trees, and they are only found as a narrow fringing to the banks of the small streams, until we approach the mountain feet, and there we find the pine and piñon abounding. The main growth of the upland prairies is the so-called buffalo-grass, a short, tufty variety, in which the buffalo and cattle delight, and keep in good condition even through the winter. In the valleys of the small streams a coarse variety of grass grows, often to the height of several feet. These, and a few other kinds, will in most autumns lie on the ground and retain nearly as much of their nutritive properties for the animals as if cut and cured. Over the eastern portions of the plains this grass-covering is most complete; on the western, in large tracks, there is often but little growth, other than that of the cactus, of which only the prickly-pear can be made of service, occasionally, to man. One element in the cause of this sparse growth westward is the less rainfall there, though other causes exist, one of which is the marked inferiority of the soil.

The meteorology of the whole region is of peculiar interest. The annual rainfall in the eastern portion of it will not probably average twenty inches, and diminishes westward until the mountains are reached, near which it will not average much more than ten inches annually. It increases, however, somewhat in the mountain region proper. The fall of rain in the eastern portions is more generally in the fall and spring and winter, while towards the west, more particularly near the mountains, the rain occurs only during the summer months, and then a small rainfall happens each day for several weeks together, the remaining portion of the day being cloudless. The whole number of rainy days for all the table land is but small as compared with the east; they will not probably average, at any one place in the plateau region, annually more that thirty-five or forty. This is an important point bearing directly on the climatic effect, and is one to which we shall again refer. Snow-storms, except far north, are generally of short duration, and not of very frequent occurrence. Hail-storms, though rare, give hail-stones remarkable for their large size. Fogs are very infrequent, and of short duration. The winds have considerable force more or less continuously; this is especially the condition in Western Kansas and Eastern Colorado, though it applies to the whole region. We frequently may have day after day of the brightest, warmest sunshine, in which the wind will blow almost a gale. We have no data as to the average wind-rapidity, but it is very great.

As is known, the temperature decreases for the same latitude in proportion to the elevation, though this decrease is not so marked in the region in question as might be expected. Thus, at Fort Harker in Kansas, at an elevation of 1856 feet above the sea, the mean temperature is 51° F., while at Fort Garland in Colorado, in nearly the same latitude, but with an altitude of 8,500 feet, we have a mean of 45½° F.

The temperature of the lower levels of the eastern part of the plateau, often reaches 105° F. in summer, but it is rarely oppressive, owing to the small amount of moisture in the atmosphere, and the rapid surface evaporation and its effect. The extreme cold in the latitude of Kansas is rarely below 7° F., though north and west, as for instance at Fort Laramie, in Wyoming, it ranges from 15 to 21° below zero. These lower temperatures, however, are not frequently of long duration. Sudden changes from higher to lower degrees of temperature, nowhere very infrequent, are often quite marked. Winter, in the latitude of Kansas and Colorado, rarely commences till the middle or end of December, and spring in many years will be well at work at the end of February. Isothermal lines from points on the east coast, which may ascend somewhat in latitude before reaching the plains region, descend markedly afterwards, until the Rocky Mountains are crossed, and then as rapidly ascend to strike the Pacific coast at many degrees of latitude above their eastern starting-point.

The atmosphere (as has been said of the whole region) is relatively very free from moisture; so much so is this the case, that even during the warmest weather, meat cut in strips can be dried and cured without salt or the action of smoke. The earth's surface dries very quickly after the fall of rain or snow, the latter disappearing in vapor as fast nearly as it melts. In New Mexico, and some parts of Colorado on the level, a snow-fall of three or four inches will very generally melt in a few hours, and may leave the ground on which it had lain perfectly dry. Assistant Surgeon Miller, United States Army, in his report of the Medical History of the Post of Fort Reynolds, Colorado, compiled by Assistant Surgeon Billings, United States Army, and published by the Surgeon General, in Circular No. 4, of 1870, refers to this fact, and says, on a certain night in January, 1868, snow fell to the depth of two inches. In the morning following not a "particle of snow was to be seen on the ground, and the latter was quite dry." This I have witnessed several times. Ozone is believed to exist in large quantity in the atmosphere of the plateau region, though no observations as to this were made, or are obtainable. The consideration of the effect of the Rocky Mountain table-land region on the healthy man, either when born in it or acclimated, might be almost wholly dismissed with the statement that after a somewhat extended observation in Kansas, Colorado, and New Mexico, we believe there is no region of the earth probably so free in itself from the active causes of disease, none where people under ordinary hygiene can and do present such healthy appearance, or more vigorous constitution. The rich glow of the complexion of those who have lived in this region long is noticeable, while those of even excellent health from the eastward, in this respect present at first on the plains a remarkable contrast, and by the comparison may *appear* even unhealthy.

It is obvious that our material for observation as to the effect of the climate of these altitudes is neither very large in amount, nor can it, save exceptionally, extend over the period of several past generations to a present one, the only people who have thus inhabited them being mainly the Indians and New Mexicans, though the former may well be eliminated, with the exception of the Pueblo tribes, who are civilized, fully as much as most of the New Mexicans, and whose habits are very similar. What, therefore, is said of the Mexicans here, may well apply to them also. Our somewhat extensive observations among the people of New Mexico have this result: that notwithstanding some few direct causes for disease, and deficiencies often as to food and clothing, and the inhabiting of badly ventilated dwellings, we believe them to be as healthy a race, and as long lived and free from bodily defects and deformities as any that exist. They are not of large stature generally, their habits are not industrious, and they have not shown intellectual development; but these latter defects are not due to climate, but must be ascribed to their origin and mixed descent. That they are a hardy people, capable of great bodily fatigue, no one who has seen them can doubt. We have no data to give as to their longevity, but one cannot but be impressed with the fact of the large number of very aged people among them.

To the healthy man going to these higher levels for residence there is a certain amount of acclimation, or rather of becoming accustomed to them, to be gone through with as far as the heart and lungs are concerned; for the former organ must work harder to enable the latter (which have to expand the more fully) to effect the oxygenating changes in the blood, which changes, as is well known, take place less readily under the diminished atmospheric pressure. With care, however, this matter gives little or no trouble to healthy persons. Among the diseases that are of rare occurrence we may include those of malarial origin. Except in the valleys of the streams in lower levels of the plateau, and not often there, intermittent and remittent fevers are not observed; and even there, during dry summers, the rule is an absence of the poisonous cause. On the bluffs bordering these valleys, though they may be but fifty feet higher, a security from infection is obtained. In the higher levels, near and among the mountains, no cause malarial is believed to exist.

The disease known as mountain fever we did not see, though cases have been frequently reported as having occurred at several posts at the great altitudes. Our own impression is that its cause at least is mainly that of depression produced by over-exertion without proper nourishment and shelter, and that elsewhere it might be called an ally of typhoid. Pneumonia will generally be found to accompany and complicate it. Typhoid fever is very rare, and during several years' service in the table region, we saw but three or four unmistakable cases, and these were of mild form; and such is the general testimony. The rarity of cases of solar exhaustion, even in the warmer portions, where in summer the thermometer may range day after day above 100° F., is worthy of note, and is interesting as bearing on the theory lately advanced as to the cause of this affliction, namely, the accumulation of bodily heat; such an accumulation being almost impossible where, with the rapid

surface evaporation we must have produced a relative surface cooling. Phthisis pulmonalis is quite rare. During several years' service in Kansas we remember seeing no case that had its origin there, and we saw but one in New Mexico among the native people; and such is the report of a majority of the medical men who have served in these regions. The Medical History of the Post of Fort Harker in Kansas, has the following reference to this subject: "The rarity of consumption is remarkable, and the first case has to be seen in which the disease began to be developed here; a majority of the patients treated for it, in whom its commencement took place elsewhere, have been much improved." Ordinary scrofulous troubles are unknown, and diseases of the joints, such as morbus coxarius, and of the bone, such as carious disease of the spine, are almost so.

There are, however, some few peculiar causes at work for disease, even here, which in this otherwise remarkably healthy region are difficult to understand, or to reconcile with our causative theories for some of the same diseases at our lower levels eastward. Of the first and more striking, probably, we may notice erysipelas, which we found occurring idiopathically quite often, and frequently too it complicated wounds. This is the case over a large portion of the table lands. We observed it at Fort Harker, in Kansas, and we had cases of it at Fort Union, New Mexico. Generally it appeared in persons who had not been subjected to any known unhealthful influences. To show that this was not alone the result of our own observation in the localities in which we were able to witness it, but was also the experience of others, we quote from the Report of the Medical History of the Post of Fort Frederick Steele, Wyoming Territory, as follows: "A great tendency to erysipelas and a disposition of all wounds to take on erysipelatous action have been observed." Other and similar quotations might be given. We will add here that generally these cases yield to treatment readily, and local measures were the only ones we applied. Inflammations of the lungs, contrary to what is generally believed, are far from being infrequent; over a large portion of the greater altitudes of this region, and in New Mexico and some parts of Colorado, it has several times assumed an almost epidemic character. Thus, in the winter and early spring of 1871 and 1872, this was the case near Fort Union, New Mexico, and along the upper valley of the Pengaloue in Colorado, — the disease among children being the more frequent and fatal. It prevailed, we are informed by Acting Assistant Surgeon Tunnell, United States Army, in Santa Fé, the winter before last, more especially also among children. As to the frequency of pneumonia at other points, we will quote from one or two of the reports of medical officers of the army, as published in Circular No. 4 previously mentioned. In the report of Fort Craig, New Mexico, latitude 33° 38′, at an altitude of 4,576, we find as follows: "Pneumonia occurs somewhat frequently, and is apparently epidemic in character, occurring more frequently among the inhabitants than the troops." Assistant Surgeon Vickery, United States Army, in his report of the Medical History of Fort Wingate, New Mexico, which is at an elevation of over 7,000 feet, says "about the only pulmonary disease is a little pneumonia each winter of mild type." As there are few if any inhabitants

in the country surrounding the post, this must apply to the troops. The report of medical officers of the station at Santa Fé, published in the circular quoted, on this point was as follows: "From February to May, pneumonia, rheumatism, and erysipelas prevail to some extent, but when occurring in persons of good physical condition, are easily managed. As a general thing bronchial affections are not severe or frequent." At the lesser altitudes we find that both pneumonia and erysipelas are of rarer occurrence, and this is especially the case so far as the former of these two diseases is concerned, even in higher and colder latitudes of the lower levels, and rarely if ever does it assume there the epidemic form. Thus at Fort Harker in Kansas, the report of the Post gives the following: "Pneumonia and pleurisy are somewhat rare, mild bronchial inflammation in the winter furnishing most of the pulmonary cases." And such is the report from a majority of the stations at these eastern and lower portions of the plateau. The whole subject of the frequency of pneumonia at the greater altitudes is a very important one in its climatic bearing, and the fact of the existence of these lung inflammations is not generally known to us of the east here. This matter will be referred to again in relation to its influence on those who, suffering with pulmonary affections, may have this region selected for them as a residence. Pleurisies do not apparently bear the relative frequency to the pneumonia, which we find at the east. Neither asthmatic difficulties nor chronic bronchial troubles are of very frequent occurrence in the older inhabitants or native people. Among new comers, if there exist an asthmatic predisposition, the disease will certainly be provoked. Heart diseases are not common. We are unable to frame any entirely satisfactory hypothesis as to the cause of this frequency of the lung inflammations, though we believe some peculiar cause exists other than that which might be referred to the necessarily increased action of the lungs dependent on the elevation, plus the active evaporation from their air-cell surface. We have thought that the same irritating atmospheric cause of erysipelas, be that what it may, has some intimate relation in the production of these lung affections. If these diseases have separate and distinct causes, they would seem to be at any rate often co-workers as to time.

The comparative frequency at the higher levels of the table land country of hemorrhage after labor was observed by us, and is another matter not readily accounted for. It has been noticed by several of the medical officers of the army serving in that region. Assistant Surgeon M'Clellan, United States Army, in his report of Fort Garland, Colorado, which has an altitude of 8,365 feet, remarks on this point as follows: "Hemorrhagic labors are common; out of nineteen cases delivered under my care since August, 1868, fourteen were complicated by post-partum hemorrhage. In these cases, with one exception, the hemorrhage occurred after delivery of the placenta." Abortions, miscarriages, and menorrhagic disorders are common. Our own experience was quite similar to that of Dr. McClellan, and we found post-partum hemorrhage rather the rule than the exception. Menstruation commences probably earlier than elsewhere, and among the Mexicans ceases sooner than in the east. Among other diseases which we would, from our

preconceived ideas as to cause, hardly expect to find in this region of atmospheric dryness, we may mention rheumatism both acute and chronic; its prevalence particularly in the latter form, being much more common than at the Atlantic sea-board. It increases in frequency the nearer we approach the mountains.

Consider now the selection of this region by persons affected by disease needing a climatic change, and first of all and mainly those having lung difficulties. The belief has been, and is yet generally held, we have found even among physicians at the east, that it is suitable for all pulmonary complaints and in any and all of their stages, and with little consideration as to the general condition of the individual. This, we are convinced, is an error, and one which has resulted in much injury to numbers. We met in the high levels of New Mexico with many cases of phthisis, sent there from the east, and our opinion after a careful observation of them, was, that they were not only not improved, but that their disease rather progressed. This we think to be mainly due to an inability and disinclination to exercise, which is our great and only reliance in the treatment of phthisis. The cause of the difficulty as to making bodily effort is obvious, and found in the fact that breathing with a diminished lung surface at the great altitudes, in a person otherwise enfeebled too, — not an easy matter even while at rest, — becomes often a source of great distress whenever moderate out-door exercise is attempted. We think, therefore, that all our consumptives should be excluded from the very high level, no matter what the stage of the disease may be, especially when we remember, too, the risk which is incurred of an inflammation being added to the previously existing lung difficulty. But, we may be asked, are we to shut our phthisical patients out entirely from all parts of this plateau? Are there no portions of it possessing advantages not readily had elsewhere for these sufferers? Undoubtedly there are, and they are found at its lower portion, where with an altitude of not more than three or sometimes even four thousand feet above the sea, we have all the advantages of a dry atmosphere, with day after day of cheering sunshine, and the occurrence of few, very few days in which out-door exercise can be interfered with. The region now referred to is found in Kansas, a large portion of Colorado, and southern New Mexico; though we think even there the cases should be selected for it while the disease is yet in the earlier stages. One practical point in reference to sending patients affected with phthisis to a new climate anywhere, and one too often overlooked, is the necessity for mental and bodily occupation. After invalids arrive in their new home, with nothing but their disease to occupy their mind, and with exertion wearily undertaken as a health measure alone, both mental and bodily exercise are by them but incompletely attended to. Some occupation necessarily involving out-door work should be urged, — and on the plains much ingenuity in finding it is fortunately unnecessary.

The portions of the plateau region which I have pointed out as suitable for our phthisis patients, will also do well for those affected with chronic laryngeal and bronchial inflammations. Asthma, though it may be relieved temporarily, is apt to return here as elsewhere, and there are therefore no

advantages for that class of cases. In debilitated states of the system, without organic lesions, the region possesses some advantages, especially in such affections as dyspepsia. Organic heart difficulties should not be sent here — they could but be increased.

If our views above given are correct, the conclusions to be arrived at as to the climatic effect of the table land region, then, may be expressed as follows : —

1st. That to the healthy individual, with ordinary care, the region of elevation, even including the greater altitudes, will not effect injury, but rather add vigor.

2d. That there are in the higher regions some few causes only of disease, which may be avoided by ordinary hygienic care.

3d. That at altitudes not to be greater than three, or at most four thousand feet, we have a climate very well adapted to the residence of phthisical patients — though even there the cases should be selected, and to receive benefit must be sent to it in the earlier stages of the disease. That these same levels do well for chronic bronchial affections.

4th. That certain forms of debility and indigestion, without organic lesion, do well. That in the organic heart affections the disease would be added to, and that such cases should never of course be sent here.

ABSTRACT OF SPECIAL REPORTS BY ARMY MEDICAL OFFICERS ON THE EFFECT OF MOUNTAIN CLIMATES UPON HEALTH.

By J. S. BILLINGS, M. D.,

Assistant Surgeon United States Army.

READ AT ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 12, 1874.

Dr. Billings, as authorized by the Surgeon General, presented the following facts from the records and correspondence of the Army Medical Bureau : —

Charles Smart, M. D., Assistant Surgeon United States Army, at Fort Bridger, Wyoming Territory. Altitude of post, 7,010 feet. From the table presented by this officer it was seen that acute rheumatism, conjunctivitis, catarrh, quinsy, laryngitis, and phthisis are especially the diseases of the station. These would seem, with the exception of the conjunctivitis, to be developed from climate influences. The immunity from consumption possessed as a rule by the inhabitants of elevated lands has led to belief in the curative influence of a residence in such climates, provided the disease be in its incipient stage, and provided the patient can stand it. The cases noted are in the incipient stage, perhaps free from everything but the hereditary predisposition, for it cannot be assumed that these soldiers were doing duty while in the advanced stages. Altitude may be preventive of consumption in all cases where the residence is commenced early enough, but in view of given figures and of other con-

siderations, such as the diminution in the quantity of oxygen through lessened air-pressure, the residence should commence during the period of development — not of the disease but of the body. As the time for this has passed in the majority of instances where the question of change of climate comes to be considered, this station must be set down as unsuitable, either from excess of altitude, requiring too great a strain upon the weakened lung, or from excess or deficiency of some of the other climatic elements, such as temperature and its variations, winds, and moisture, which, though in general terms dependent on altitude, are oftentimes materially modified by local circumstances.

J. H. Patzki, M. D., Assistant Surgeon United States Army, at Post Fred Steele, on the Union Pacific Railroad, between Omaha and Salt Lake City, and west of the Black Hills, altitude of post 6,140 feet, reports that the prominent feature of the climate is the dryness of the atmosphere, due partly to the elevation and partly to the geographical relations of the place, the prevailing western winds condensing most of their moisture upon the western slope of the Rocky Mountains. The dryness of the air produces irritation by rapid evaporation from the mucous membrane of the air passages, at least an unpleasant sensation of dryness and thirst is very perceptible to the new-comer. This irritation is enhanced by the deep, expansive inspiration by which the organism apparently compensates the diminished amount of oxygen in the atmosphere. The rate of respiration is not at all or but slightly increased, and is even apt to be slightly reduced, but the inspirations are deep, and in persons unacclimated occasionally irregular, and of a slightly spasmodic character. Exertion appears to produce some discomfort by increasing the frequency of respiration. Another striking peculiarity of the climate is the extreme range of temperature. A daily variation of forty degrees is frequently observed, of fifty degrees not rarely, and of sixty degrees occasionally. The range of temperature is closely connected with the dryness of atmosphere, as the small amount of aqueous vapor allows the surface of the earth to be rapidly heated by the rays of the sun, and rapidly cooled at night by radiation. The dryness of the atmosphere, though in the beginning unpleasant and irritating, appears at the same time inimical to the development of serious pulmonary diseases. But seven cases of pneumonia and pleurisy occurred during the last six months, and but one case of consumption, no cases of asthma having been observed.

W. H. Gardner, M. D., Assistant Surgeon United States Army, at Fort Union, New Mexico, on the eastern slope of the Rocky Mountains, altitude of post, 6,700 feet, reports that at his station wind from some quarter is almost constant, and the soil being light and sandy is blown about in clouds of blinding, suffocating dust that irritates the air passages, and is the prevalent cause of catarrh, pharyngytis, and bronchitis. The diurnal variation in temperature is very great, the thermometer frequently showing at 6 A. M. but 60°, and at 2 P. M., 97°. Even in midsummer one or more blankets are always comfortable to sleep under. Dr. Sardon believes that the whole Mexican population is so much under the influence of syphilization, that the disease when it does occur is much modified, as small-pox is

when it occurs after vaccination. In treating these cases use is made of a native plant of very high local reputation and of undoubted efficacy.

Edwin P. Vollum, Surgeon United States Army, at Salt Lake City, altitude of post, 4,800, reports that the adult population of Salt Lake Valley are as robust as any within the borders of the United States, and there is a fair number of cases of extreme old age. The weight of sickness falls upon children, who furnish not less than two thirds of all the deaths, most of which occur under five years of age. The figures of the register show that the male deaths exceed the female in number about fifty per cent. The polygamous children are as healthy as the monogamous, and the proportion of deaths is about the same. The difference is rather in favor of the polygamous children, who are generally in the city, especially situated more comfortably as to residence, food, air, and clothing, their parents being better off than those removing away. Regarding the influence of the altitude and climate of Utah on phthisis, it may be set down as favorable. Dr. Vollum's experience with that disease during the past four years has been very small, and his testimony might be regarded as in favor of the climate. At Camp Douglas his observations have been confined to a few incipient cases among the troops who came from a distance with it, and were discharged.

REPORT ON THE PUBLIC HEALTH SERVICE IN THE PRINCIPAL CITIES, AND THE PROGRESS OF SANITARY WORKS IN THE UNITED STATES.

BY ELISHA HARRIS, M. D.,

Secretary of the Association.

PRESENTED UNDER RULES OF THE ASSOCIATION AT ITS ANNUAL MEETINGS IN 1874 AND 1875.

THE interchange of information upon subjects which most concern the public health and the success of the studies and duties for promoting it has become an important element of this Association's usefulness. The officers of Municipal and State Boards of Health, physicians, naturalists, civil engineers, architects, and all classes of public-spirited citizens have spontaneously sought for information and suggestions respecting sanitary questions; and they have, in turn, freely given information and caused useful reports to be sent to the Association.

In the absence of unity, and even of system, in local sanitary organizations, and with trustworthy statistics of mortality in only a few of the cities, in less than ten of the States; with medical officers overtaxed with executive duties, unused to exact methods of investigation, and but poorly paid for their official service, the time may not have arrived yet for the gathering in of as complete reports, sanitary facts, and the records of prevailing causes of sickness and mortality as the members of this Association wish; but in the highest ranks of physicians and other enlightened citizens throughout the United States and Europe there is evinced such a profound interest in the objects of sanitary inquiry and public health-care which called this Association into existence, that, for the present, the correspondence and interchanges with us from unofficial hands nearly equal in amount and value our official exchanges.

The information received by us is susceptible of classification and some degree of analysis, fitting it for purposes of instruction or reference in the publications of this body, and in a much condensed form we present the more useful statements under the four heads here following.

PROGRESS OF THE STATE BOARDS OF HEALTH.

The report on the Laws and Organization of the State Boards of Health, as given in the first volume of the Association's Papers, showed that even the limited powers under which State Boards have organized have been successfully employed, and that the work of inquiry and advice has been made publicly acceptable and useful.

In Alabama and Texas the formal organization of a State Board of Health has been effected solely as a movement of the medical profession, organizing medical inquiries and certain kinds of effort, but unsustained by

adequate authority of the State. The excellent examples of the State Boards of Massachusetts, Michigan, Minnesota, California, and Maryland, cannot be successfully followed without an effectual support of statutes and some pecuniary resources; but the leadership and organization of the best-educated physicians in any one of the States, for the purpose of securing a Central Board of Health, naturally precede and prepare the necessary legislation. Such action in the medical profession is rapidly extending to all the educated classes and the citizens who most concern themselves with the social and economic questions of the times. The same causes which called the American Public Health Association into existence are inciting the leading citizens in nearly every one of the United States to consider the duty and means of organizing an efficient sanitary system. This brief review of the progress of work by each of the State Boards as already organized will be read as a supplement to the report on the same subject in the first volume.

STATE BOARD OF HEALTH OF ALABAMA.

An act of the General Assembly of the State was passed at its session in February, 1875, establishing Boards of Health in the State. Under that act "the Medical Association of the State of Alabama, organized in accordance with the provisions of the Constitution, which was adopted by said Association at its annual meeting in the city of Tuscaloosa, in March, 1873, is constituted the Board of Health of the State of Alabama." Its duties are defined as follows: —

"Section 2. Be it further enacted, That the Board of Health of the State of Alabama, thus established, shall take cognizance of the interests of health and life among the people of the State; shall investigate the causes and means of prevention of endemic and epidemic diseases; shall investigate the influences of localities and employments upon the public health; shall from time to time make to the General Assembly such suggestions as to legislative action as in their judgment may seem advisable; and shall be, in all ways, the medical advisers of the State."

Under this act, the city of Mobile has proceeded, through its Mayor, Aldermen, and Common Council, to re-cast and to revivify its municipal Board of Health. The controversy — indeed, the very determined opposition — evinced in a political way, has already proved that the first triumphs of the State Medical Association taxed its utmost resources of argument, patience and prudence. The Board of Health of Mobile has at last been organized under the auspices of the Association, with the best wishes of all good citizens for this first success of a law that no other State of the Union could have adopted.

STATE BOARD OF HEALTH OF CALIFORNIA.

This Board, organized in the spring of 1870, and consisting of seven physicians, continues to work nobly, though with inadequate financial resources to secure all the results at which it has aimed each year. Its reports, published every second year, do credit to the working ability of the members.

Under its organic law the Board organized a system for the registration of births, marriages, and deaths. The medical profession throughout the State generously responded to the requirements of the Board, whose secretary acted as the general registrar; but, for want of adequate clerical aid, that officer recommends in his recent report that this branch of the Board's service, so far as expenditures and clerical aid are required, be performed by the Secretary of State. This, of course, is a mere matter of expediency in respect of expenses and a central bureau worthy of a great State.

The last report presents information upon the subject of Irrigation, Sewerage, Drainage, Local Diseases, Climatology and Phthisis, the Condition and Wants of the Insane and Inebriate Classes, the Vital Statistics of the Chief Cities, and the Sanitary Development of Hospitals, Asylums, and other State Institutions.

An elaborate report on malarial diseases and phthisis pulmonalis by the Secretary, presents an illustrated and carefully-studied history of the *eucalyptus globulus* — the alleged prophylactic defence against malaria. Dr. W. P. Gibbons, of Almeda, discusses at length the influence of Forest Culture in its Prophylactic Sanitary Relations; and various contributors to the general work of the Board have added sanitary papers of popular character, for publication in the general report which was presented to the Governor in July, 1875.

STATE BOARD OF HEALTH OF GEORGIA.

This Board was organized in the city of Atlanta June 9, 1875, and consists of nine members, "physicians of skill and experience," appointed by the Governor, and of four *ex officiis* members; namely, the State Geologist, the Attorney General, the Comptroller, and the elected Secretary. The appointed members hold office for six years, in succeeding groups of three each. The powers and duties of the Board are comprehensive yet uncomplicated. They are: (1.) To devise, collect, and preserve the vital statistics of the State. (2.) To obtain and diffuse information upon leading sanitary subjects. (3.) To advise with and aid local sanitary authorities throughout the State, and coöperate with and supervise quarantine authority at the several ports. (4.) To supervise the duties of local authorities with respect to births, marriages, and deaths, and to obtain full returns from coroners. (5.) To report annually to the legislature the results of their labors.

The first few months' work of the Georgia Board seems to have resulted in more universal popular support, as well as in that of the medical profession, than any other State Board of Health has experienced at the beginning, except, perhaps, that of Massachusetts. Every locality, and almost every practitioner of medicine in Georgia, has been brought into official relations to the State Board by the reporting of the current vital statistics. The President of the Board states that, at the first quarterly meeting after organizing, the members found valuable information was rapidly accumulating, in addition to the vital statistics, and that six important

papers and reports were offered for the first annual report.[1] The current work of this Board is distributed among its committees on hygiene, schools, public institutions, and prisons; endemic, epidemic, and contagious diseases; geology and topography; poisons and dangers to life and health; prudential matters; legislation and laws, etc. The registration of vital statistics was organized at the very inception of the Board's work, and the forms of each branch of registry are nearly identical with those employed by the Bureau of Vital Statistics in New York. The local magistrates, known as the Ordinaries, in each county, procure and send forward to the Secretary of the State Board, at Atlanta, the certificates of births, deaths, and marriages.

STATE BOARD OF HEALTH OF LOUISIANA.

The statute under which the Board of Health of New Orleans exists also as the Board of Health of the State of Louisiana, confers only the shadow of authority to do or permit any effective sanitary service by the Board. The little which is authorized relates to quarantine and certain proceedings against pestilential diseases. The excellent executive and expert works of the New Orleans part of the State Board's service, for the past six years, should warrant the proper extension and definition of the powers and duties of the State functions of the Board.

The public importance of a suitable system of external sanitary police, at the quarantine stations below New Orleans, and in the city itself, is greater than at any other port in the world, while the importance of a central authority, vested in a State Board of Health, that shall act promptly and effectually for the immediate control of yellow fever, at any point within State jurisdiction, is a matter of momentous interest to all the regions south of Memphis and Shreveport. The events of 1873 show that at least three other States, besides Louisiana, suffered immensely from the incursions of yellow fever, which the State laws of Louisiana were impotent to restrain. No mere laws of quarantine can be so framed and adapted as to suit the varying requirements which a State Board of Health, with competent discretion, would need for arresting the progress of this scourge of our tropics. Discretionary powers, not inflexible rules, are of supreme importance for a State Board of Health in Louisiana.

STATE BOARD OF HEALTH OF MARYLAND.

The work of this Board was organized in the spring of 1874, under a law which conferred adequate power of inspection and inquiry, and required that its members should devise some scheme whereby medical and vital statistics of sanitary value may be obtained; "also to act as an advisory board to the State in all hygienic and medical matters; and to make

[1] The first report comprises a review of the subject of vital registration, with instructions and forms; the practice of vaccination, and prevention of small-pox; the hygiene of schools; the sanitary influence of trees; restriction of poisons; the organization of local boards, etc. The Legislature has authorized the State Board to aid, and, in certain cases, to actually establish local sanitary authorities.

special inspections of public hospitals, prisons, asylums, and other institutions, when directed by the Governor or the Legislature."

This Board has begun its inquiries in a thorough manner, and has, from the first, acted upon the belief that the State can and will sustain its work, and that the organization of local Boards of Health, and the development of a system of registration of vital statistics which shall be adequate for the purposes mentioned in the law creating the State Board, will require the aid of local sanitary officers to serve as district registrars. Actual records of sound medical observations, the Board claims to be the correct basis of a useful administration of public health laws. The preparation of a basis for organizing a system of vital registration; the investigation of evidence concerning the relations of enteric fever to common water-supplies, and especially the perilous state of well-water in the city of Baltimore; the examination of questions concerning the malarial areas, and the decrease of malaria in the State; the careful inspection of prisons, asylums, and hospitals; and the preparation of an outline of necessary sanitary legislation to secure the efficient organization of local Boards of Health, and the study of questions connected with methods of dry-earth conservancy of excrement, — have occupied the official attention of this Board during its first year.

STATE BOARD OF HEALTH OF MASSACHUSETTS.

The Annual Reports of this Board offer ample evidence that the inspection, inquiry, and popular instruction by which great sanitary improvements are preceded, may be so conducted as to promote constant support of the local reforms to which public inquiry thus directs attention. The success of this Board in building upon the sure foundations of large inquiries and carefully prepared and widely disseminated information in which the people take great interest, affords perhaps the best example yet witnessed in the world in the preparation of a State for all the interference which may be reasonably desired from public health laws. This great example is fortunately adapted to aid the work of organizing sanitary service in every town and city, as well as in the other States. The old statutes and very defective methods for obtaining the records of mortality have not prevented this Board from maintaining its own system of inquiry into the prevalent causes of death, and by such inquiry much has been accomplished for the welfare of the people before the records of causes of death throughout the State could be brought under the official supervision of the Board. Let it be here remarked that, when the Massachusetts law was adopted and its Board organized in 1869, it would have been impossible to have secured to the State Board any control over or interference with matters pertaining to vital statistics and the certification of causes of death; but now, after seven years' experience of its beneficent operations, the duty of exercising a direct supervision over the records of death, and inquiries into causes of disease and mortality, is quite generally confessed to be one of the most legitimate and important that can be imposed upon the State Board of Health. Already in the city of Boston, the municipal Board of Health is

required, under the new charter of that city, to assume this duty, notwithstanding the old system of the State at large, which left these matters in the hands of town clerks and municipal registrars, who act independently of all sanitary authority. The published abstracts of medical evidence and reports on the causes of mortality in the chief towns, the varying influence of local conditions of insalubrity, and a comprehensive study of some of the general causes of disease, impart to the yearly reports of the Board a specially instructive and convincing quality which warrants the legislature in publishing its editions of many thousand copies for public use. The manner in which the Board has dealt with the subject of abattoirs and butcheries, and the nuisances of Miller's River; with foods and poisons; the transportation of food animals; the pollution of streams; and with the sources and quality of water-supplies, affords a perfect example in public health service. The courts of Massachusetts have at length come to treat the evidence and conclusions presented by the State Board of Health as being in the nature of expert decisions.

The special reports on Drainage and Sewerage, Drainage to protect Cellars and Wells, Causes of Consumption, the Sanitary Wants of Farmers and Common Homes; on Homes for the Poor, Infant Mortality, Hospitals, Inebriate Asylums, Insane Hospitals, and the Ventilation of Railway Cars; on School-rooms, Tenement Houses, Vaccination, Offensive Trades, and on numerous other topics, have added largely to the most practical kind of sanitary literature, and elicited an enlightened support of sanitary work throughout the State. The hydrographical survey of the State for the purpose of securing needed legislation for preventing the pollution of streams and for securing pure water-supplies in the towns and cities, is one of the latest benefits procured by this Board. A thorough topographical survey will next follow, for the Board has shown the necessity for it as the basis of systematic drainage and an accurate treatment of numerous sanitary problems.

STATE BOARD OF HEALTH OF MICHIGAN.

The excellent balance and breadth in the constitution of this Board, the expert ability of its Secretary, who is *ex officio* registrar of vital statistics for the State, the patience and thoroughness evinced in the researches of various members of the Board, and especially the direct influence and intelligence which the officers of the Board have brought to bear in all the schools throughout the State, have made this Board one of the best educators — especially of young people and children — that any State has yet had in its central Board of Health.

The registration of vital statistics for Michigan being under the direction of the Secretary of the State Board of Health, as the Registrar General, this State Board has enjoyed a signal advantage over any other State Board of Health. The Registrar is kept constantly informed of the movements of diseases, and the causes of mortality. The local sanitary authorities throughout the State are required to make formal reports to the Central Board of Health at least once a year, and to maintain official correspond-

ence, and give special information as the latter shall request.[1] The official forms by which these local reports are procured, and the circulars of infor-

[1] The circular of Rules and Regulations recommended by the State Board for adoption by all local boards is presented here as an epitome of sound advice, and of the useful methods of the State Board in its relations to the latter : —

RULE 1. No privy-vault, cesspool, or reservoir into which a privy, water-closet, stable or sink is drained, except it be water-tight, shall be established or permitted within fifty feet of any well, spring, or other source of water used for drinking or culinary purposes.

2. Earth privies, or earth closets, with no vault below the surface of the ground, shall be excepted in Rule 1, but sufficient dry earth or coal ashes must be used daily to absorb all the fluid parts of the deposit, and the entire contents must be removed monthly.

3. All privy-vaults, cesspools, or reservoirs named in Rule 1 should be cleaned out at least once a year ; and from the first of May to the first of November of each year shall be thoroughly disinfected by adding to the contents of the vault, once every month, one or two pounds of copperas dissolved in a pailful of water.

4. No privy-vault or cesspool shall open into any stream, ditch, or drain, except common sewers.

5. Within the limits thus bounded : ————, which area shall constitute health limits, no night soil or contents of cesspool shall be removed unless previously deodorized by mixing with solution of copperas ; and during removal the material shall be covered with a layer of fresh earth, except the removal be by the "Odorless Excavating Process."

6. All sewer drains that pass within fifty feet of any source of water used for drinking or culinary purposes shall be water-tight.

7. No sewer drain shall empty into any lake, pond, or other source of water used for culinary purposes, nor into any standing water within the jurisdiction of this Board.

8. No garbage, materials manufactured in whole or in part of wool, silk, leather, India rubber, etc., or other materials which evolve offensive gases during combustion, shall be burned within the health limits of this corporation [or township].

9. No house offal, dead animals, or refuse of any kind shall be thrown upon the streets or left exposed by any person, and no butcher, fishmonger or vendor of merchandise of any kind, shall leave any refuse upon the streets, or uncovered by earth upon the lots of this city [village or township] ; and all putrid and decaying animal or vegetable matters must be removed from all cellars and out-buildings, on or before May first in each year.

10. All families, hotels, restaurants, and others accumulating garbage, are required to have a proper covered receptacle for swill and house offal, and to cause the contents to be regularly removed as often as twice a week between the first day of May and the first day of November, and once a week at all other seasons.

Reasons for 9 *and* 10. Decomposing animal and vegetable matters are the sources of poisonous gases, dangerous to health.

11. Between the first day of May and the first day of November, no hogs shall be kept within the limits named in Rule 5, except in pens with floors, kept entirely free from standing water, and regularly and freely disinfected ; and during the months named no hogs shall be kept elsewhere within the jurisdiction of this Board within eighty rods of any dwelling, except in pens with dry floors, or kept free from standing water.

This Board will order the removal of such animals at any time, when they appear to be prejudicial to the public health, safety, or comfort.

12. No animals affected with an infectious or contagious disease, shall be brought or kept within the limits of the jurisdiction of this Board, except by permission of the Board. No diseased animal, or its flesh, and no decayed, diseased, or unfit meat, fish, vegetables, or fruit, or diseased, impure, or adulterated milk or other article, shall be sold or offered for sale as food.

13. No slaughter-house or abattoir shall be established or used as such within the limits specified in Rule 5, and none elsewhere within the jurisdiction of this Board, unless kept free from all obnoxious smells, and all offal be removed every day ; and no melting or rendering house, and no place for manufacturing or other business giving rise to obnoxious or

mation and rules and regulations for the use of local authorities, are excellent models.

The annual reports of the Michigan Board already embody valuable papers from the local boards of health, and from physicians in all parts of the State; reports on School Buildings and School Hygiene; the Sanitary Condition and Wants of the Public Institutions; the Entailments of Al-

injurious vapors or odors, shall be established or used as such within the jurisdiction of this Board, except by its special permission and location.

Vaccination.

14. Every child should be vaccinated before two years of age; and this Board recommends that all persons be revaccinated as often as once in five years.

15. All incorporated manufacturing companies within the jurisdiction of this Board shall cause each new employee to be vaccinated on entrance, unless proof is furnished of previous successful vaccination.

16. No person shall become a member of any public school within the jurisdiction of this Board until vaccinated, or furnishing a certificate from some physician that he or she has been successfully vaccinated.

17. Any householder in whose dwelling there shall occur a case of cholera, yellow fever, scarlet fever, diphtheria or small-pox, shall immediately notify the Board of Health of the same, and, until instructions are received from the Board, shall not permit any clothing or other property that may have been exposed to infection to be removed from the house, nor shall any occupant take up residence elsewhere without the consent of the Board.

18. Any physician who may be called to a case of any of the diseases specified in the foregoing rule shall at once report such case to this Board and receive instructions in regard thereto; and whenever there shall come under the observation of any physician such number of cases of scarlet fever, measles, typhoid fever, diphtheria, dysentery, or cerebrospinal meningitis as in his opinion to justify the belief that a considerable epidemic thereof exists, he shall at once report the same to the Board, with such suggestions in regard thereto as may seem to him best.

19. No person or article liable to propagate a dangerous disease shall be brought within the jurisdiction of this Board without the special consent and direction of the Board; and whenever it shall come to the knowledge of any person that such person or article has been brought within such limits, he shall immediately give notice thereof to this Board, together with the location thereof.

20. No person sick with any of the diseases specified in Rule 17 shall be removed at any time except by permission and under direction of the Board.

21. Persons affected with any of the diseases specified in Rule 17, and all articles infected by the same, shall be immediately separated from all persons liable to contract or communicate the disease, and none but physicians, nurses, and the clergyman of the family shall be allowed access to persons sick with these diseases.

22. Persons recovering from any of the diseases specified in the preceding rules, and their nurses, shall not leave the premises till they have been thoroughly bathed, and their clothing disinfected by washing in boiling water, or heating to 250° Fah.

23. All vessels used by such patients shall be disinfected by solution of carbolic acid or chloride of lime, then emptied, their contents buried in earth, and the vessel cleansed with boiling water.

24. All personal clothing, bedding, towels, etc., and all articles in contact with or used by the patient, shall be washed in boiling water, or exposed to a temperature of 250° Fah.

25. Infected feather beds, pillows, and hair mattresses shall have their contents removed and disinfected by thoroughly exposing them to the fumes of burning sulphur, and their ticks washed in boiling water; but no article shall be burned without the direction of the Board. Infected straw beds and excelsior mattresses shall have their contents removed and buried, and their ticks washed in boiling water.

cohol; Resuscitation of the Drowned; Poisons and Poisonous Wall-papers; Illuminating Oils; Disposal of Excreta; Water Supplies in Towns; Drainage for Health; Epidemic Cerebro-spinal Fever, etc. The Board has in its first two or three years of effort made so great an impression in favor of public health-care and works for sanitary improvement in the towns and cities of the State, that its counsel is now sought, and its warnings and suggestions heeded. Its intimate advisory relations with local sanitary authorities, and its exact and statistical methods of inquiry are distinguishing excellences of this Board.

STATE BOARD OF HEALTH OF MINNESOTA.

Now completing its third year of work, this Board continues to make definite progress in the various researches it has undertaken, and it is influencing in an admirable way, the sanitary welfare of all the State institutions in the nature of asylums, prisons, hospitals, and schools. Its Secretary, Dr. Charles N. Hewitt, has from the beginning of the Board's work, devoted much of his time to the duty of public instruction in hygiene throughout the State, and is *ex officio* the professor of hygiene of the University of Minnesota. The vital statistics of the State are not under its immediate supervision, but the causes of death and the records of mortality are registered in accordance with forms prescribed by the Board.

THE HEALTH COMMISSION OF THE STATE OF NEW JERSEY.

The legislature, at the close of its session in the spring of 1874, authorized the appointment of a commission to report upon the sanitary wants and public health-interests of New Jersey. That duty was intrusted to able hands, who studied their problems carefully and reported promptly and well upon the field of their inquiries, before a year had expired. The answers to its various inquiries came in from all parts of the State and fully sustained the cause for which the legislature had directed these inquiries to be made; but the project of law that was submitted by this commission failed of adoption in the legislature of 1875. The main object, however, has been attained in New Jersey; namely, the effectual awakening of public concern in the duties of sanitary improvement, especially in systematic drainage, pure and abundant water-supplies for the cities and villages, complete records of mortality, and the maintenance of a central source of sanitary information and coöperation to facilitate local sanitary service. The final adoption of the recommendations of the New Jersey Sanitary Commission of 1874, and the incorporation of them into the statutes will not be long postponed.

STATE BOARD OF HEALTH OF TEXAS.

Dr. A. R. Kilpatrick, of Navasota, Texas, writes to the Public Health Association: "At the meeting of the State Medical Association of Texas, at Dallas, in 1873, there was formed and organized a State Board of Health and Vital Statistics. This body has applied to the legislature to pass such laws as are necessary to carry out measures for the improvement of the health and longevity of our citizens. At this time there is in session the

convention for the formation of a new State constitution, and members of that body have introduced resolutions for the establishment of 'A Bureau of Vital Statistics and Public Health,' to be a part of our State government and a regular department in our executive machinery."

This instance of an effort to establish a general Board of Health without the authority of statutes, evinces an earnest purpose to induce the State to provide suitable laws and a system for administering them for the protection of the public health in Texas. The invasion of the chief lines of travel by yellow fever in this State in 1867, and, from Shreveport, in 1873, proved needlessly disastrous because of the absence of a central source of authority and advice. The drainage and purification of large towns are calling for the service of a State Board of Health.

STATE BOARD OF HEALTH AND VITAL STATISTICS OF VIRGINIA.

The fourth year of this Board's work has not secured the support for which its members have patiently waited. The necessary forms of law for securing an accurate registration of vital statistics have been submitted to the legislature; the laws and means for providing general vaccination are also asked for. The members of this Board have shown wherein the economy and prosperity of the State will be promoted by public health measures, and the time must soon come for the working out of problems of improvement submitted by the State Board of Health. Upwards of 500 square miles of the richest of its domain consist of reclaimable swamps which are now nearly uninhabitable, yet would become gardens and prolific fields if systematically drained; upwards of 20,000 deaths testify annually that in this naturally most salubrious of the Southern States the preventable causes of sickness and mortality are rife, in the presence of malaria upon nearly a thousand square miles of its richest lands, all, or nearly all of which can be wholly reclaimed to great healthfulness and fertility by systematic drainage. In view of the economic and other great interests of Virginia which will be promoted by the operation of sanitary measures recommended and supervised by its State Board of Health, the organization and plans of that Board should not be given up. With nearly one and a quarter millions of inhabitants, Virginia has great need to give ample support and authority to its central Board of Health. Richmond, Norfolk, and Petersburg, have organized a local sanitary service under the authority conferred by statute on town councils concerning quarantine, small-pox, vaccination, and restrictions on unwholesome foods; but in no other State is there greater necessity for a central source of hygienic advice and a skilled supervision of sanitary service and the registration of vital statistics. The frequent and excessive prevalence of the more preventable causes of fatal endemic diseases, especially those of the malarial and enteric kinds, in the richest districts of the State, calls for the most exact and comprehensive inquiry and aid by the State Board of Health.

The seven physicians, whose public spirit induced them, in 1872, to accept the duty of organizing the State Board of Health, under the statute passed in February of that year, still continue their work, but the State

continues oblivious to the duty of encouraging the work in a liberal way. The last line of the statute here referred to still remains unamended; it reads: " . . . . provided that the said Board of Health shall not in any way be a charge upon the State."

Charged with the duty of "taking cognizance of the interests of health and life among the citizens generally," and required to "devise some scheme whereby medical and vital statistics of sanitary value may be obtained, and act as an advisory board to the State in all hygienic and medical matters, especially such as relate to the location, construction, sewerage, and administration of prisons, hospitals, asylums, and other institutions," they still have no pecuniary means supplied for proceeding to accomplish these results. Fortunately they do not despair of yet attaining the objects for which the law was enacted, for it is merely a question of time when the old Commonwealth shall emerge from the financial embarrassments which now hinder the development of its internal improvements.

NOTE. — While this volume is in press, members of the Association in Colorado and Wisconsin communicate information of the adoption of Statutes for instituting a Central Board of Health in each of those States.

STATE BOARD OF HEALTH AND VITAL STATISTICS OF WISCONSIN.

This is the tenth in the list of State Boards of Health. It organized in the spring (1876), and issued its first circular of information early in July. It is composed of seven members, a single one being subject to appointment by the Governor and Senate in each successive year. The statutory provision for and organization of this new Board of Health are closely in accordance with the plan proposed and published by the American Public Health Association in February, 1875. The following abstract of Sections 2 and 4, shows the plan of the Board's operation:

(2.) "The State Board of Health shall have the general supervision of the interests of the health and life of the citizens of the State, and shall especially study vital statistics, and make intelligent and profitable use of the collected records. They shall make sanitary investigations and inquiries respecting the causes of disease and especially of epidemics; the causes of mortality, and the effects of localities, employments . . . . on the health of the people, and they shall gather such information in respect to those matters as they may deem proper for diffusion among the people. They shall, when required, or when they may deem it best, advise officers of the government, or other Boards within the State. . . . . "

(4.) [*Secretary.*] " . . . . He shall communicate with other State Boards of Health and with the local Boards of Health within this State. He shall prepare blank forms of returns and such instructions as may be necessary, and forward them to clerks of the several Boards of Health throughout the State. He shall collect information concerning vital statistics, knowledge respecting diseases, and all useful information on the subject of hygiene, and through an annual report, and otherwise as the Board may direct, shall disseminate such information among the people."

OBSERVATIONS ON THE SANITARY CONDITION AND PUBLIC HEALTH-CARE OF THE PRINCIPAL CITIES IN THE UNITED STATES.

COMMERCE and the great routes of travel and trade have predestined the geographical location of the chief cities in the world, and this fact is more remarkably noticeable in the New World than in the Old. The deep bays and secure harbors by the sea-coast, the great rivers that flow deeply and slowly, or have the longest influx of tidal currents, and the vast river basins with the inevitable concomitants of alluvial and marsh lands, furnish the grand pathway of commerce, and along these channels of the world's trade spring up the cities and great centres of population. The description of the public hygiene of a city is utterly defective unless its sanitary topography, its drainage, sewerage, and water-supplies are placed in the record.

As great nations accept the necessity for defence and war, so cities accept and must employ the defences of hygiene, and the duty of maintaining an armament against the enemies of health. The great cities grow greater, and new ones vie with the older. Civilization accepts all their disadvantages to health, and, whether along the swampy Thames, or the Tiber, or on the marshes of the Neva, the submerged grounds along the Mississippi, at New Orleans, or upon the swamp of Chicago, or in the malarial regions of Charleston, Savannah, or New York, the behests of civilization which grow with the growth of commerce, demand that the problems of public health shall be wrought out in these cities.

In the study and correspondence which we are pursuing in the name of the Public Health Association respecting the hygiene of our American cities, valuable information has been daily accumulating.[1] Some portions of it are herewith submitted for the use of the Association. The following statements present, —

1. An epitome of facts relating to the sanitary topography of these cities, grouped in geographical districts of our country, according to altitude and river-basins.

2. A brief statement showing the methods of sanitary organization, the progress of sanitary works, and the conditions which most affect the public health in these cities.

3. A statistical schedule of facts concerning the sanitary state of the cities.

The last national census found 21.8 per cent. of the total population in the United States residing in cities and populous villages. Fifty of the cities contained 5,784,778 inhabitants, and in the 311 cities and large towns which had at that time municipal modes of local government, there dwelt 8,452,315. Within the same municipalities there dwell at the present time not less than 9,500,000, for the mean rate of increase of population in these

[1] Memoranda of endemic and epidemic diseases in the cities and large towns of the United States, with an abstract of the statements of correspondents, are excluded from publication in this volume by the necessity for condensation.

cities is from 1.5 to 2.5 per cent. yearly. The census in 1870 found 21.91 per cent. of the total population of the nation dwelling in these fifty cities.

The number of the cities, and the eager strife of all to vie with each other in offering enticements to trade and population, impart peculiar characteristics to the domestic and sanitary conditions of the city population.

THE SANITARY GEOGRAPHY AND TOPOGRAPHY OF THE CITIES OF THE UNITED STATES.

The Maritime Cities and those upon Rivers with an Average Altitude less than 300 feet above Tide-level. — Seventeen of the States border upon tidal waters of the Atlantic, or of the Gulf of Mexico, and the District of Columbia, at the city of Washington, receives the tidal afflux of the Atlantic Ocean by the Chesapeake and the Potomac.

Of the fifty cities in the United States which, at the time of the census in 1870, had upwards of 25,000 inhabitants each, there are twenty-five (not counting the cities of the Pacific Coast) that are situated upon or within 250 feet of tide-level. Of the 260 populous towns having over five thousand inhabitants each, and having some form of sanitary government, fifty of the largest have the same topographical relations and exposures at the tide-level as have the twenty-five cities above mentioned. These seventy-five cities and populous towns which are at or near the tide-water or tidal level of the Atlantic and its affluents, present fields for sanitary observation and study that can be made serviceable to the world.

Yellow fever has, during the past hundred years, visited and prevailed in 220 of these cities and towns, and places near them. Though peculiarly the scourge of the Atlantic tropics, this singular pestilence is liable to be conveyed to and planted in all of these localities. The promise of sanitary science is, that, without serious impediment to the interests and movements of commerce, even this pestilence will be stayed from its former habit of destroying.

Upon the map of this country a contour line can be drawn along the coasts and rivers where some degree of sanitary surveillance may always need to be exercised in certain seasons, and under certain conditions of temperature, etc., when yellow fever gains a foothold in a port with which intercourse is continually maintained by water. This fact respecting the sanitary history of the tide-water and the southern river towns of the United States has to be borne in mind whenever the prevention of yellow fever and special kinds of sanitary police measures or quarantine against epizootic diseases are in question.

The Cities upon the Affluents of the St. Lawrence River, and Lake Ontario, and the Eastern Slope of the Alleghanies. — The small cities of Vermont and northern and western New York, namely, Burlington, Vt., Watertown, Ogdensburg, Oswego, Utica, Syracuse, Auburn, Rochester, and Buffalo, in New York; and Erie, Pittsburg, Harrisburg, and other cities upon the eastern Alleghany Slope, in Pennsylvania, and the few interior cities of Virginia and North Carolina, constitute this group of cities. Having a high

altitude, and being upon the geological slopes of gneiss, transitional limestone and sandstones, and situated upon great affluents that wear their way between hills of diluvial gravel, these cities and the populous towns, which now are more than eighty in number, enjoy the natural facilities for health and the greatest length of life which can be attained in cities. The paludal malaria that in early years of their growth afflicted such cities as Syracuse, Auburn, Buffalo, Sandusky, Toledo, and Detroit, in consequence of neighboring marshes and saturated lands, is now rapidly disappearing, as a result of general works of drainage and the thorough culture of the soil. The water-supplies of this group of cities are excellent in quality, and are unfailing. The annual rainfall is heavy, varying from twenty-eight to sixty inches depth of water. Excellence of food-supplies, especially of fruits and cereals, in this central and Appalachian region, with its water-supplies and the advantages of altitude and drainage, insures the first element of security to the public health. In the notes upon the present state of the public health in these cities, it will appear that the yearly death-rate in some of them is less than eighteen per one thousand.

The Cities of the Mississippi Valley and Great Interior Basin of the United States. — The great valley, which extends from northward to southward nearly two thousand miles, and from Western Pennsylvania, Virginia, and North Carolina, to the head-waters of the Colorado and the Missouri, comprises nearly three fourths of the entire continent of North America.

The Cities of the Elevated Plains upon the Affluents of the Colorado and the Rio Grande and Western Branches of the Missouri.—The cities of Denver, Santa Fé, and Salt Lake, at the western base of the great mountain axis that had shut off the Pacific from the East until the railway threaded through the passes, are situated at altitudes which offer new opportunities for sanitary study. Health government and vital statistics have scarcely become organized, but, so far as known, the enormous death-rate in infancy and the acuteness of inflammatory diseases, and certain fevers which gravely affect the nervous system, are facts of chief importance in those regions.

The Cities of the Pacific Slope and Coast. — These cities and the regions they occupy offer the latest and in some respects very promising fields for obtaining the most complete healthfulness and long continuance of life. The habitable globe nowhere else offers for man's use more perfect food, better water, or more invigorating climates. The peculiar disadvantages of the new cities and the bad influences of evil habits have given death-rates that correspond with excessively active causes; but the health government of the cities is bearing most promising fruits.

THE SANITARY ORGANIZATION AND HEALTH OF THE CITIES.

In the order of their commercial importance and the number of inhabitants, each of the large cities will now be noticed.

NEW YORK. — The municipal Department of Health is governed by a Board of Commissioners, consisting of two expert scientific men, the Chief Medical Officer of Quarantine, and the President of the Board of Police. The first two are appointed by the Mayor and Board of Aldermen.

The executive service of this Board comprises one superintendent and one assistant superintendent, ten sanitary inspectors, and from ten to thirty assistant inspectors, all educated physicians, who give nearly their entire time to the Board's service; and a disinfecting and cleansing corps, under the superintendence of an expert chemist.

The Bureau of Vital Statistics of the city is allied to the Health Department, and its registrar is appointed by the Board. The records of the Bureau and researches which are steadily in progress therein are daily tributary to the discovery of causes of disease and to the promotion of sanitary duties.

An exact record of the causes and local circumstances of mortality in each district, and in every tenement dwelling, is maintained as a part of the daily service of this Bureau of Vital Statistics. About one half of the inhabitants of the city being in tenement or congregate dwellings, in which four or more families reside, at monthly rentals, this class of records has a special importance. The fact that none of these tenement inhabitants own any share in their dwellings is one of the most serious matters in their social history.

This department has legislative powers. Its enactments, in accordance with general provisions of the State laws, are sustained by the highest courts. The system has worked most satisfactorily and successfully from 1866 until the present time. The power of this department of the city government to define and abate nuisances against the public health, and to initiate proceedings to secure the improvement of tenements and the drainage or purifying of places, confers signal advantages which the courts of last appeal have fully sustained. This authority and duty to institute all proceedings for the application and enforcement of sanitary laws and regulations, and to hear and judge of evidence, and, if necessary, take proceedings for the actual execution of important orders whenever the parties offending are delinquents, was, during the first few years, earnestly contested; but the Board's authority to enforce compliance with its requirements within the assigned sphere of its jurisdiction is now rarely disputed.

The practical importance of this example of sanitary administration in the largest American city is well stated by the author of the Metropolitan Health Act of New York (1866), Hon. Dorman B. Eaton, who, in a recent address, said: "Among all the benefits it has secured for the future I hold that by no means the least which is conferred by the decisions of the highest court of the State to the effect that, under our American constitutions, it is possible to abate the worst classes of nuisances without a resort to the delay and the expense of a jury trial. These decisions are the first solid legal bases, on this side of the Atlantic, of truly effective sanitary administration."

The degree of security to life and health in this city is not to be judged by the enormous excess of mortality that occurs during the hot season, for that increase is so specially the effect of summer cholera of the infant population in the tenement-house districts, that it is an event and a subject to be separately considered. For example, the total number of deaths in New

York in the summer quarter of 1873 was 8,983. The number of decedents who were five years of age and upwards was 3,495; the number under five was 5,488. The death-rate in that portion of the population between five and the oldest ages was equal to 15.85 per 1,000 yearly, while in the child population under five years old, the mortality was equal to a yearly rate of 185.17 per 1,000. The same amazing disparity between the death-rate of children under five and that of all older persons has continued through 1874 and 1875. After eight years of faithful sanitary efforts under the new health laws, the death-rate in the infant population shows very little decrease; the total mortality in the city shows an obvious decrease, and that decrease is found most conspicuously in that portion of the population which is between the ages of fifteen and forty-five years. Fevers and some other preventable zymotic diseases have decreased fifty, sixty, and even seventy-five per cent. since this work of sanitary reform began, and the percentage of deaths of children under five years of age has begun to decrease in a significant degree.

The number of deaths from enteric typhoid fever, in the three years preceding the institution of the present sanitary system in New York, was 1,765; the total number in the next three years was 1,248, and the total number in the year 1873 was 295. We see demonstrated in New York the fact that, while under the first applications of efficient sanitary measures in a crowded city, the rate of infant mortality has begun to be diminished, the security of life and health has been decidedly enhanced in all the middle periods of life, or from fifteen to forty-five years of age.

The city has 288.54 miles of sewers, 253 miles of paved, and fifty miles of unpaved streets. Both are under the direction of a Department of Public Works, and the cleaning of streets is under the supervision of the Police Department. The external sanitary service or Quarantine Department of the port, is under the superintendence of a Chief Quarantine Medical Officer, and is located upon an artificial island ten or eleven miles down the Bay of New York, seaward. Yellow fever has not prevailed in the city since 1822, but it has several times been epidemic along the bay shores within a mile or two of the infected ships. The sanitary measures at present in force, by the joint counsels and authority of the Health Officer of the Port and the Board of Health, afford complete security against the epidemic spread of yellow fever into the city.

Brooklyn. — The growth of Brooklyn from a village to a city of 484,616 inhabitants has occurred in a period of one generation. It is a city of homes, and recently has become a centre of great manufacturing interests.

The higher altitude of most of Brooklyn than that of New York, the greater extent of dwelling area, and open tree-planted ground about the common dwellings — for Brooklyn spreads upon its twenty-two square miles a less number of inhabitants than New York has crowded in with all its commercial warehouses upon less than five square miles — give that new city great hygienic advantages.

The water-supply is excellent, outflowing from the gravel of the southern

slope of Long Island for twenty miles in a rural district, and thence pumped into a storage reservoir high above the level of the city.

The three pumps and the affluent conduit whence they throw the supply send about 30,000,000 gallons daily to the distributing reservoir and the city.

PHILADELPHIA. — With 122 square miles of area, extending up the Delaware and the Schuylkill rivers, and with broad and straight streets and ample dwelling grounds, Philadelphia will ever be most conspicuously the city of homes and domestic healthfulness. The census of 1870 found its 127,746 families distributed in 112,366 dwellings, with an average of only six persons in a house; while the New York dwellings averaged 14.72 inhabitants in each.

The Philadelphia Board of Health consists of twelve members. Its chief Health Officer is appointed by the governor of the State; its corps of inspectors consists of thirteen non-medical men and sixteen vaccine physicians. The registration of vital statistics is under the Board's direction. The powers and methods of the Board are widely different from those of the Health Department of New York, yet large powers are given in cases in which the Board declares the existence of any nuisance dangerous to health.

Like the New York Board, it is deficient in the necessary authority to immediately enforce the cleaning of the streets.

The city death-rate is steadily lower than in New York. It was only 19.66 per 1,000 inhabitants in 1874. Its death-rate among children is much lower than in other large American cities, yet 40.40 per cent. of all deaths in 1874 were of children under five years of age. With an abundant water-supply, with unlimited extent of undulating, well-drained, and coarse diluvial ground, such as constitutes the greater part of the 122 square miles of the city, and with the best market supplies of all products of field and pasture, and a climate well tempered and the means of universal industry and thrift unexcelled, Philadelphia is, and probably will ever continue to be, the most healthful of the great commercial cities in America. Extensive portions of the older part of the city are at present in a bad sanitary condition, being badly built and crowded upon alleys and lanes, in which the relapsing fever had sway in the spring and summer of 1870, in classes as debased as those of the St. Giles and Limehouse districts of London, or the High Street closes of Glasgow.

The present death-rate in Philadelphia (21 in the 1,000 annually), may, by the agency of sanitary improvements that can readily be made in reconstruction of old quarters and by sewerage, be reduced to a yearly average of 17, or 18 per 1,000.

BOSTON. — The public health system of Boston is passing by an easy transition from the old limits of the former city — the peninsula of Boston which comprises less than 2½ square miles — to a circle of new cities and towns extending over 16½ square miles. The enlarged city now takes its place in the front rank of thoroughly organized municipalities. The old Boston is becoming a vast commercial exchange, and it gained more than

old London by "the great fire," for the width and grade of its streets, and the state of its sewerage have been much improved. The outer ring of the new Boston surpasses all other cities and suburbs in America in the diversified indulgence and opportunities of home tastes and domestic culture. The old city was becoming unhealthful from overcrowding and faulty sewerage, but the present municipality comprises the dispersed population, and has organized an efficient sanitary system. The State Board of Health of Massachusetts effectually aids the Municipal Board, and has already secured for the entire city the concentration of its abattoirs at one centre in its suburb of Brighton. Water-supplies and the general management of offensive and injurious kinds of civic nuisances are receiving practical attention from the Board of Health and City Council.

The annual death-rate in Boston has for the past fifteen years been quite steadily at about 26 in the 1,000, and the deaths of children under five years old constituted about 43 per cent. of the total mortality. Typhoid fever and diseases of the respiratory organs are relatively more frequent and fatal than in New York and Philadelphia.

BALTIMORE. — This is now the seventh in rank of population, and the fourth or fifth in the relative amount of commerce of the cities of America. Its 267,354 inhabitants at the census in 1870 enumerated 10½ per cent. as of negro origin. In the latter class of the population the death-rate is greater than in the white class.

The negro population resides chiefly in a low and badly-drained district; but the greater portion of the city and all the better classes of inhabitants occupy a series of elevated hills and slopes remarkable for natural salubrity. The limitless capacity for extension outward upon high and healthful grounds insures the public health of Baltimore. The low quarters by the harbor have in time past suffered by incursions of yellow fever, but the recent improvements in grading, sewering, and paving, and sanitary police give entire security from that pest. A quarantine station is maintained several miles down the bay, seaward.

The Board of Health is appointed by the Mayor, and its powers are defined by the City Council.

The death-rate averages about 25 in 1,000 annually, and only 30 to 31 per cent. of the total number is of children under five years old. Neither in summer nor in winter does infant life suffer as great losses as in the cities already described.

The high and diversified site of the city, the separateness of the dwellings, and the freshness of all food-supplies, are among the distinguished hygienic advantages of Baltimore.

WASHINGTON. — The national capital occupies an extensive table-land, which has an average height of about 60 feet above the high-tide level of the Potomac. But besides this higher portion, the lower grounds near the latter river are all becoming thickly populated. Malarial fevers afflict the inhabitants of the low grounds and contiguous slopes, but the drainage and sewerage of the better portions — the higher grounds — have, in the course of five years, rendered them healthful. Sharing the paludal entailments of

all the tidal borders of affluents of the Atlantic in latitudes south of 45°, the first sanitary problem at the national capital was that of thorough drainage and grading and sewering of the city.

RICHMOND, VA. — The sanitary topography of the city is favorable to its perfect drainage, and the difference in altitude between the margin of the James River and the chief dwelling streets exceeds 100 feet. Upwards of eleven miles of sewers have been constructed, the streets are paved or macadamized, and the water supply as pumped into high service reservoirs from the James River is a source of public health. The white population was estimated in July, 1875, to be 41,493, and the colored at 31,146. The death-rate in the white population ranges from about 16 to 17, and among the blacks it rarely falls below 30 per 1,000, yearly. The domestic and other special causes of this vast excess of mortality in the colored people have been well described by Prof. L. S. Joynes of that city. Though this is one of the most salubrious cities, so nearly at the tidal level, the unhygienic condition of the poor has awakened general interest in the most essential sanitary problems. The Board of Health consists of three physicians, appointed by the Mayor and City Council. It publishes faithful weekly reports of the causes of death.

NEW HAVEN, CT. — This city has an efficient Board of Health, consisting of the Mayor and six appointed members. Its front being at tide-level, and the surface of the town too flat and low for perfect natural drainage, the neglect of a thorough artificial system of draining, and a too general dependence on its thirty miles length of sewers, permit the existence of malarial and typhoid fevers, which could be prevented. This and all the essential questions of sanitary improvement, now engage the attention of the public health authorities. The water-supply exceeds 100 gallons per diem to each inhabitant. The death-rate has ranged from 26 down to 18 per 1,000 annually, and the causes of this great fluctuation are found chiefly in the state of the general drainage of the city and the sewerage of premises.

NEWARK, N. J. — Newark in New Jersey presents the same sanitary problems as most of the rapidly growing manufacturing towns. Its sanitary government is a fiction, and its health problems have received no exact treatment. Its death-rate is 30 to 32 per 1,000 yearly, and in the year 1873 over half of the deaths were of children under five years of age. This city is greatly in need of thorough sanitary drainage and sewerage, and a far more copious and pure supply of water.

JERSEY CITY. — Like Newark, this chief city of New Jersey is a vast workshop for New York, and it has become the second city in America for the docks which accommodate steamships from European ports.

The Health Board and the city government are nascent organizations striving to grasp some plan of improvement which will be adapted to the singular growth of the city. For this purpose five separate municipalities have recently been united under one head. This unity of contiguous suburbs, which had grown until they touched at all points, was necessary for sanitary reasons as well as for general police purposes.

ALBANY, TROY, HUDSON, POUGHKEEPSIE, NEWBURGH, AND YONKERS IN

THE STATE OF N. Y. — This group of cities upon the banks of the Hudson River, along a tidal course extending 150 miles northward from the City of New York, has sanitary features in common. They are upon high banks and cliffs by the river, and their growth, which is rapid, extends inland indefinitely, according to the ability and taste of the families that seek such rus-urban homes.

The health government is vested in the City Council and appointed medical officers. The accurate registration of vital statistics is neglected in all these interior cities and throughout the State of New York, except in the two metropolitan cities first described.

PROVIDENCE, R. I. — This city, with a busy population of 99,608, and a larger proportion than any other maritime city, excepting Newark, of workers in manufactories, has a well-ordered sanitary government, superintended and organized by the well-known hygienist, Dr. Edwin M. Snow.

The death-rate has for ten years kept quite steadily at about 20 per 1,000, and 36 to 37 per cent. of the total mortality is of children under 5.

Omitting further description of maritime cities north of the yellow fever zone, let the fact be noticed that from Portland, in the State of Maine, and Portsmouth, N. H., to Charleston, New Orleans, Galveston, and Memphis, by way of the Atlantic and its affluents, the summer temperature, much of the season, vies with that of inter-tropical regions; and that at the period of greatest heat and humidity, experience has taught that perils from vessels from ports in which yellow fever prevails should be guarded against, not by the old but now impolitic practices of exclusion of commercial intercourse, but by exact medical observation, and any necessary and logically correct sanitary police regulations or orders thereon founded. The present regulations of the external sanitary police systems of Boston, Providence, New York, Philadelphia, and Baltimore illustrate this principle.

CHARLESTON, S. C., AND SAVANNAH, GA. — These two great southern ports had, previous to the war, the devoted services of eminent medical scholars to aid the municipal authorities in the health government. Crippled in means, and with the great changes in their commercial affairs since the war, there is at the present time great want of a sound sanitary system in both cities. Death-rates are too high, and the means of security to health are very defective. Year after year the death-rate has exceeded 40 in the 1,000 inhabitants in each city. The sanitary problems in and about these beautiful cities are the same which are being satisfactorily solved in and about the cities of Calcutta and Bombay.

NEW ORLEANS. — Occupying upwards of twenty square miles between a curve of the Mississippi River and Lake Pontchartrain, and at a level below that of the river surface, the great city of the south, like Calcutta on the mouths of the Hoogly, or Alexandria upon the Nile, has accepted the behests of commerce, and turns now to Hygeia to find protection from the Python of the waters and slimy lagoons.

It was not until commerce had made large demands for streets and spaces by the river side that New Orleans felt, or at any rate recognized, the necessity for the sanitary preparation and defences which this emporium of the

cotton and sugar products of the delta of the Mississippi would require. The historical fact that the New Orleans of Spanish colonial times was regarded as a salubrious place, — as Dr. Lind, in his book on Hot Climates, says it was, — is not to be doubted; for it was the partial shutting off the lagoon (bayou) waters and partial drying which opened the new era of fevers and other chief perils to health in that city.

Situated nearly 100 miles from the open sea (Gulf of Mexico), by course of the river, yet bounded by the tidal waters of the inland lagoon, Pontchartrain on the north, and having its surface two feet lower than that at high tide, and ten feet lower than that of the great river, the problem of civic cleansing and drying is combined with that of the engineering, by which the river itself shall be turned to the task of daily flushing and cleansing of streets and gutters on the one hand, and on the other hand, of so effectually pumping and dyking off the waters as to secure healthful dryness of the city's surface. This problem is being successfully but slowly solved. The Board of Health is steadily securing the execution of larger works for these two great means of health.

Drainage canals and basins are at once open cesspools and the channels for cleansing away the foul outflowings of the city. The daily and constant outward flow through them to the great outfalls by which they enter Pontchartrain by means of the draining machines, that are placed at the intersection of the drainage canals and bayous which conduct the water northward to that great lagoon or lake, both cleanses and drains the city.[1]

The present system of public health government comprises medical members appointed by the Governor, and other members by the Municipal Council, and the administration of sanitary laws and regulations, which are partly of State origin and in part the offspring of city legislation. The quarantine system comprises inspection and anchorage stations, with hospitals, some seventy miles down the two principal outfall branches of the river.

The members of the Board may take action upon quarantine questions affecting the welfare of other portions of the State, and when so acting they constitute a State Board of Health.

All cemeteries consist of tombs wholly above ground.

The water-supply is directly from the Mississippi River, for common uses, but the rain-water cisterns are largely preferred for domestic supply.

The annual death-rate fluctuates from thirty-three to fifty in the one thousand. Infants under five years of age give from thirty to thirty-eight per cent. of the total mortality. The waste of infant life in the white population is less than in the cities of New York and Chicago, but in the negro population the infant mortality is excessive, being nearly double that of the whites.

A mean temperature of from eighty-eight to ninety-two degrees Fahr.

[1] Eight or more drainage machines are kept incessantly in motion, lifting the water and sewerage out of the drainage canals and basins to higher levels and beyond the dykes and levees, thence onward pouring the foul flood into the lake. A single one of these machines is capable of sending forward 100,000 cubic feet of fluid per minute.

prevails from the middle of May until the middle of September, accompanied by a degree of atmospheric humidity equal to 77.4 of total saturation. New Orleans has nearly the same atmospheric conditions to favor the prevalence of yellow fever that Vera Cruz, Havana, Jamaica, and the Barbadoes have, where it is indigenous; yet there are good reasons for the opinion that it never was indigenous in the former city, or upon any portion of the Mississippi banks.

The drainage works are projected upon a colossal scale; the drainage machines are succeeding in wholly withdrawing the water from some thirteen thousand acres of surface in such manner as to make healthful grounds. The present limits of the area to be drained by the four steam-propelled machines comprise about twenty-six thousand acres.

The improved machinery that was set in motion for draining a vast marsh and water-covered area, upwards of 4,500 acres in extent, and which had always been thus covered, soon completely withdrew the surface and upper stratum of soil-water, and, as the machine-wheels are unceasingly in motion lifting the water from its outfall canals and basins, the worst district of the city is now becoming healthful. The annual death-rate from malarial fevers, mostly "congestive bilious fever," in the populous Third District, which is contiguous to this newly-drained area, has decreased from 4 to 3.4, 2.8, and finally to 1.9 per 1,000 inhabitants. That is, there is not half as much fatal fever in the adjacent three square miles now, as in the years before this special drainage was devised.

By the arithmetic of such drainage a good lesson in the economy of health is taught. To aid in understanding the importance of such decrease in the fevers we may properly take the hospital records of the great Charity Hospital of New Orleans, which, in the five years preceding the late war, admitted 50,033 patients, and of that total number 14,702 had malarial fevers, 3,155 yellow fever, and 1,033 typhoid and enteric fever.

The death-rates previous to these drainage works averaged about forty-six in the one thousand annually, and its monthly extreme range was enormous, being found all the way from thirty-one to seventy-eight per one thousand yearly rate, for the months of February and September as minimum and maximum periods. But the day of sanitary improvement has dawned upon this city of the south, and already the life assurance risk has been diminished twenty per cent. for the ages between twenty and fifty years; and as the risk was, until within ten years, one hundred per cent. greater at those ages than it was and now is in Philadelphia, New York, Baltimore, and Providence, it may be well for the world to estimate the value of sanitary improvements by the money value and assurance risk of a man.

Mobile, Galveston, and other Cities at or near Tide-level of the Gulf. — These cities and ports are all liable to occasional incursions of yellow fever. They are built upon the sand or coraline bottoms of the old-time sea-shoals. Their means of drainage and sewerage, and the defectiveness of water-supplies of good quality and adequate quantity, are permanent obstacles to good sanitary conditions. Not one of them yet has a sound health government, excepting Galveston.

San Antonio, Texas. — This beautiful and salubrious inland city is a sort of Dresden in the southwest of the United States. It is a centre of cultivated German society and thrifty enterprise.

With about eighteen thousand inhabitants, upon thirty-six square miles, and with an unlimited area for the extension of the town, it has a good sanitary government. Its vital statistics are carefully registered and interpreted for hygienic and politico-economic purposes.

Its death-rate is twenty in one thousand, and only thirty-one per cent. of the mortality is of children under five years of age. The water-supply of San Antonio is a marvel of natural springs, which pour forth at a distance of only two miles from the city, a river of the purest water, sufficient to supply one million of inhabitants.

Baton Rouge, Natchez, Vicksburg, and Memphis, upon the Mississippi; and Natchitoches and Shreveport on the Red River (affluent of the Mississippi). — These important inland ports are located upon the bluff river sides, and each has an average altitude of less than 266 feet above sea-level. Each one is capable of being made as healthful as any city similarly located as respects altitude and the near surroundings of paludal districts. They are mainly built upon the sides and table summits of steep bluffs of sand-rock and diluvium, while near by, and for hundreds of miles beyond, alluvial grounds are at once the prolific source of wealth and paludal malaria. These cities enjoy a sufficient breadth of elevated lands to secure the means of health when their sanitary government shall have been duly organized and arrayed against the existing causes of epidemic fevers. Even the city of Natchez, which is perched upon a steep hill-top or bluff which looks down upon the great river 260 feet beneath an almost perpendicular precipice, has suffered again and again from yellow fever introduced at the steamboat landings, and spread by the perfectly well-known and preventable causes against which a sound system of public health government would effectively guard.

The city of Vicksburg, sixty-five miles northward and upon the same side of the Mississippi River as Natchez, is built upon hills reaching an altitude of 350 feet above the sea, and which are deeply intersected by ravines. Its sanitary government, like that of Natchez, and the smaller ports of the river and bayous, is not competent to protect it against incursions of yellow fever, and of the still more fatal congestive malarial fevers, which can be prevented only by systematic drainage of vast areas of inland plantations, as well as the ravines and basins of the city itself.

The ports of Natchitoches and Shreveport, on the Red River, in Louisiana, have suffered for want of sanitary drainage and police of the towns and their immediate vicinity. The city last mentioned is located 532 miles from New Orleans, up the Mississippi and Red rivers, and has an altitude of 220 feet above the sea. Unskilful grading and bad streets, and the wholly unpoliced condition of the streets and quarters, afforded an open field for the fever that in the year 1873 swept through nearly all habitations in which residents ventured to remain. Beginning on August 12, in a population of 12,000, it attacked upwards of 3,000 of the 4,500 who remained,

and killed 759 of its victims. Though plainly introduced from Havana *via* Orleans, it at last pervaded the city so universally, and extended so widely inland, wherever people fled "with purse and scrip" (for the goods of healthy persons became carriers of infection, just as Dr. Lyon proved at Lisbon), that common opinion announced the medical fallacy that yellow fever spread by means of personal contagion. The cash value of the losses by this one sweeping of a pestilential fever in and near a little city of twelve thousand inhabitants, exceeded the sum by which sanitary security could have been given to the town for a century by suitable local improvement and the establishment of a sound health government. It was the second visitation of yellow fever to Shreveport and the up-river region. The fever was spread to a hundred or more trading towns, small hamlets, and plantations in districts where it could not become generally epidemic, yet was epidemic in particular houses into which its exotic cause was brought.

MEMPHIS. — This is the chief commercial city of the State of Tennessee, upon ground 250 to 300 feet above sea-level, and by river 250 miles farther from the gulf than Shreveport; in the year 1873, it suffered for the third time from the West Indian scourge.

This city is, like all the other chief cities upon the Mississippi River banks, built upon a high bluff and its table-lands beyond, but the immediate fluvial margin and unpoliced little patch of undrained low grounds and neighboring streets by the waterside, offered all the facilities for planting and reproducing the germs of pestilence. The time and conditions for starting the deadly growth came, when, on August 10, a river steamboat from New Orleans with yellow fever epidemic on board, hauled up along shore and put a dying patient and his "kit" into the cabin of a poor Irishman, in the low and filthy place by the river-side before mentioned. The poor population in that infected cabin soon sickened and died, and thence the pest swept along, house by house, and street by street, up the hillside; and through the lowest grounds, and by the ravines, and streams, it swept most fatally, until November 20, destroying 1,300 lives in that half of the forty thousand inhabitants who did not flee. One fourth of these residents were attacked, and more than one in every four of the sick died. The chaotic state of the municipal government, and the want of law and authority to sustain the Board of Health in its duties, left the march of infection and its terror unchecked.

Cities upon the Northern and Eastern Slopes of the Appalachian Ridge. — The fourteen most northern and northeastern States, whose cities are comprised in this group, have concentrated in their cities and large towns vast industries in iron and all kinds of manufacturing. By their thrift and wealth, together with the advantages of natural conditions of salubrity, this northern group of cities present already, in their young growth, several instances of remarkably good sanitary results, such, for example, as that of Rochester, in the State of New York, Cleveland, in Ohio, and Detroit, in Michigan. In all of these cities the inhabitants are more generally educated and thrifty, and, to a large degree, they occupy dwellings which they own and improve as family homesteads.

With birth-rate equal to thirty-three per one thousand, and about twelve

per cent. of the population being children of five years old and under, most of these cities have a death-rate in that class so much less than is experienced in the maritime cities, that this cause of gain to life renders the general rate of mortality considerably lower than in the latter.

Burlington, Vt.; Watertown, Utica, Oswego, Syracuse, Auburn, Rochester, Elmira, and Buffalo, N. Y. — These nine cities are examples of the smaller class of cities which have become most important manufacturing and trading towns, having unlimited means of commercial communication with the great lakes and with maritime ports. They have grown from small hamlets without greatly changing their characteristics of tree-planted towns, with unlimited area for the extension of wide streets for the separate homes and gardens of families. They are favored by nature with all the means of public salubrity. The occasional severity of cold, and an exposure to more sudden alternations of temperature than the regions further south, render the prevalence and fatality of diseases of the respiratory organs correspondingly greater than in cities south of the forty-second parallel of latitude. The death-rate in these cities need not exceed sixteen per one thousand annually; it does not often exceed this ratio in Burlington and Rochester, where the drainage, water-supplies, and wide distribution of the population afford the best security to health. These cities have a death-rate a little less than twenty per one thousand.

Cleveland, Sandusky, and Toledo, Ohio; Detroit, Mich.; Chicago, Ill.; and Milwaukee, Wis. — These cities of the great lakes have advantages of pure water-supply, and of an unbounded inland extension of dwelling area, thereby securing the most essential means of permanent sanitary well-being.

Cleveland. — This chief city of Northern Ohio presents an example, like that of Rochester, in New York, of a great manufacturing population living so intelligently and healthfully in well-ordered and well-distributed homes, that the chief sanitary questions are favorably settled by the modes of domestic life, and most of the public health regulations which need to be enforced are willingly accepted as public obligations by the people. With a population of 100,000, and an altitude of about 650 feet above sea-level, and about one hundred feet above the surface of the lake at its side, Cleveland enjoys, as a great portion of the State of Ohio does also, the climate of the vine. The death-rate in Cleveland, since water-supplies and sewerage have been introduced throughout the city, has averaged about nineteen in one thousand annually. The sanitary experience of Cleveland, like that of Rochester, may justly be quoted as that which the smaller and best-ordered inland cities and large towns enjoy when they have systematically drained the town site or laid on a good supply of pure water.

Chicago. — With nearly four hundred thousand inhabitants, this city is the growth of a single generation. It is forty-three years since the military forces which were hastening forward to conquer the American Indians in the vicinity were delayed and decimated by cholera that went with them from Buffalo to the barrack hospitals at Fort Dearborn, on the present site of Chicago: the survivors of the cholera looked out upon vast swamps,

through which Chicago River without visible motion passed into Lake Michigan. Upon the western shore of that lake sprang up the city, so rapidly and so defectively planned and built, that the chief streets and buildings had to be elevated to a higher grading in order to secure dryness and sewerage, and which at last were swept by conflagration in 1871. Yet Chicago grows as no other city ever grew, regardless of sanitary and topographical disadvantages, for its shipping depots for the cereal grains and for animals used for food are the greatest in the world. A masterly treatment of its chief sanitary problems has already been commenced in Chicago. They comprise the following leading points: —

First. — The introduction of an ample supply of pure water from a distant station of ingress in the midst of Lake Michigan, nearly three miles off shore, into all portions of the city. This work is now accomplished.

Second. — The thorough drainage and sewerage of the city by a system of main outfalls and a series of intercepting sewers, the emptying of which into the lake shall be effected by means of machinery, without using or defiling the sluggish river. The engineering problem now also contemplates draining a portion of the city by an artificial channel into the Illinois River and the Mississippi, for this great city plain is on the "hydrographic divide" between the Gulf of Mexico, by way of the rivers just mentioned, and the St. Lawrence, by way of the lakes and Niagara Falls, and is at an altitude of 578 feet above tide.

Third. — The grading and filling of all low-lying grounds of the city.

Fourth. — The sanitary and commercial regulation of the movement and slaughtering of food animals, so as to give entire immunity to the city while a million and a half of the animals are slaughtered, packed, etc., and another million every year is moved alive through the city to eastward regions.

Facts relating to the sanitary government and death-rates in Detroit, Sandusky, and Milwaukee, being less accurately published, must be omitted in this review, though the public works and sanitary condition of each of these cities are upon a favorable footing, like those of Chicago and Cleveland.

Passing at once from these cities of the northern lakes and from those of the eastern slope of the Appalachian ridge, we view upon the latter a vast country, where the abounding wealth of agricultural or of mineral and fuel products has built up a series of commercial cities and large trade towns. The second group comprises the cities upon the banks of the Ohio and the Mississippi from Cincinnati to St. Louis, St. Joseph, and Little Rock.

PITTSBURG. — This city is the Birmingham of America. Situated at the confluence of the two most eastern sources of the Ohio River, and in the midst of the largest coal-fields of the continent, Pittsburg has become a city of iron-workers. Its population amounts to 121,485. Its death-rate in 1873 was 26.5 per one thousand inhabitants, and fifty-one per cent. of the total mortality was of children under five years of age.

Elevated 700 to 1,312 feet above sea-level, and in a region cut and diver-

sified with ravines and sharp hill-sides, the city has some crowded and insalubrious quarters for its poorest classes. In those quarters cholera has again and again gained a foothold.

City of Allegheny. — This outgrowth from Pittsburg is a separate municipality, with a population of sixty thousand. It is situated at the base and along the side of steep hills, partly within the deep ravines. Its death-rate in 1873 was twenty-one per one thousand inhabitants. It is a city of iron-workers and mechanics, with large families of children. The deaths of those under five years of age constitute sixty per cent. of the total mortality.

Wheeling. — Elevated between 625 and 850 feet above sea-level, and subject to the endemics which most afflict valleys in high altitudes, this trading and manufacturing town presents sanitary problems similar to those of Pittsburg. With a population of twenty-five thousand and upwards, Wheeling has a death-rate of sixteen to eighteen in one thousand annually. The Mayor and City Council constitute the Board of Health.

Columbus, Ohio; Bowling Green, Ky.; Knoxville, Chattanooga, and Nashville, Tenn., and one hundred and fifty other smaller cities and populous places in the regions north of the southern boundary of Tennessee and Missouri, were visited by epidemic cholera during the summer of 1873. In each city and place thus afflicted the epidemic made known some one or more — usually several — glaring defects in the sanitary supervision of the place which suffered. The most conspicuous defects consisted in the failure to supply pure water from extra-urban sources, the general use and bad condition of earth-privies, and the filth-sodden and undrained condition of extensive areas in the places that suffered. The chief centres of population and trade in the States of Kentucky and Tennessee were invaded by cholera, while the Atlantic slope was exempt, for it came from New Orleans, northward.

Cincinnati. — Elevated 575 feet above the sea-level, and being 1,600 miles from the mouth of the Mississippi, this city, with a population of 246,000, stands first in its sanitary relations as it does in commercial importance in the Ohio valley.

The Board of Health of Cincinnati consists of six members, appointed by the Mayor and City Council. The executive service of the Board is conducted by a chief health officer and twenty-nine district physicians, together with an inspector of milk, and an inspector of meat and animals used for food. The city being compactly built, and being locked by a ridge of steep hills upon the north, suffers a high temperature in summer; the mean being 74° Fahr. in summer, 53.90° in autumn, and 53.70° in spring. The death-rate at present and in recent years is about twenty-three per one thousand inhabitants, and between forty-four and forty-six per cent. of the mortality occurs in children under five years of age. The death-rate is fifty per cent. less during its recent experience with a thorough system of drainage and sewerage than it was in the period previous to these sanitary improvements. Like all great commercial cities, Cincinnati finds that public health measures are measures of public economy.

Louisville. — Elevated 450 feet above the sea-level, and being 176 miles

nearer the mouth of the river than Cincinnati, Louisville holds commercial and sanitary rank with the former. The various engineering improvements by which the latter city has been redeemed from endemic fevers, have rendered it one of the most generally healthful of western cities, though Louisville once had a death-rate of nearly one hundred in one thousand inhabitants. It now vies with Cincinnati in its sanitary condition.

INDIANAPOLIS AND EVANSVILLE, IND., AND DAYTON, OHIO. — These and numerous other new and rapidly growing cities in the States of Ohio, Indiana, and Illinois have laid out and begun to build upon vast areas of ground, without first draining and preparing the site of the future city. As the cities grow by accretion of inhabitants, so the consciousness of such sanitary necessities grows. In a single instance — the first in America — the wealth and enterprise of an unhealthful city, Chicago, were successfully appealed to for the preparation and complete construction of a suburban town that should be outfitted for healthful and truly desirable residences. That suburban elysium was completed and offered to the people of the great city at rents and fee-simples most reasonable, but the dwellings remain untenanted, and its walks, parks, and drives seldom visited, while the city is rapidly growing outwards to them.

ST. LOUIS. — This central city of North America has a site unsurpassed for the indefinite extension of its population and manufactures. Its trade commands a boundless river front from the mouth of the Missouri southwards along the western bank of the Mississippi.

Elevated 475 feet above the tide level of the mouth of the Mississippi, and being 1,276 miles from it, it is the first great commercial place to the northward of New Orleans that can boast of entire immunity from yellow fever. That scourge has seemed to be harmless to St. Louis, however frequently its victims arrive sick and dying on steamboats or by railways, as they did arrive in the autumn of 1873, and frequently before. The estimated population of this city is 450,000. Its growth is rapid beyond any precedents, except those of Chicago and San Francisco.

The sanitary topography of St. Louis would be healthful, except that the elevated plateau upon which the city is being extended westward, is dotted with ponds and saturated areas, which are held secure against all surface drainage by the eroded rock and its impermeable earth covering. Thorough drainage, therefore, is the chief sanitary problem of St. Louis, for the water-supply of the city is as pure and excellent when filtered, as it is turbid and thick when moving onward in the Mississippi. The city death-rate is not excessive, ranging as it does from twenty to twenty-five per 1,000 inhabitants yearly ; but this city is capable of becoming conspicuous for salubrity and a low death-rate. Its climate is mild; the mean yearly temperature being 55° Fahr., and its mean summer temperature being 76.10°.

The Cities of the Elevated Plains of the Rocky Mountains. — The cities of St. Joseph and Jefferson in Missouri, Leavenworth in Kansas, and Omaha in Nebraska, present no new sanitary problems ; for, like the other cities of the great River Valley, they grow by indefinite extension upon the plains beyond the original town sites.

Westward from Kansas, Arkansas, Iowa, and Nebraska, the new towns upon the elevated plateau near the axis of the Rocky Mountains offer some novel sanitary experience, and some highly important problems concerning the sanitary preparation and care of rapidly growing towns. For the most instructive example of such experience, the cities of Denver in Colorado and Salt Lake City in Utah, are specially worthy of mention.

DENVER. — Elevated 5,350 feet above sea-level, and in a rainless atmosphere most of the year, the 25,000 inhabitants of Denver have found that an ample and trustworthy supply of pure water is the first requisite of health and safety in their city. The problem of sewerage and civic cleanliness is allied with that of the water-supply. Guided by able medical men, some of whom are members of the City Council, the public works for providing the water-supplies from the melting snows of the mountains in the spring, by a vast storage of reservoirs, have been devised, and at the same time a sewerage and cleansing system has been commenced.

SALT LAKE CITY. — Elevated 4,351 feet above sea-level, this strange city, which was becoming decivilized by the presence of polygamy, until the spirit of commerce aroused the inhabitants to a moral consciousness, has begun to take rank as a well-ordered town. Its population in 1873 was estimated at 26,000, of which 431 died. The official records show that 301 of the deaths were of children under five years of age. In this excessive mortality of its children, the Mormon city exhibits to all the world the proof of the vicious and deteriorating physical state of a polygamic people.

SANTA FÉ. — This, like other towns upon the grand plateaus along the routes of mountain travel, has become a resort for invalids who seek a dry, rarefied, and cool atmosphere. Santa Fé has an altitude of 6,846 feet above sea-level. It is the only city, except St. Augustine, Florida, of the old Spanish domain of a past century, which, in the United States, retains the style and many structures of the Creole Spanish period.

Cities of the Pacific Coast. — From Astoria and Portland in Oregon to San Francisco in California, the numerous towns which have assumed the form of a municipality in their local government have had to deal chiefly with the old duty of cleanliness of the crowded quarters in which fevers and enteric diseases threatened to become endemic. It will suffice to mention here the facts concerning the sanitary government of the chief city of the coast.

SAN FRANCISCO. — The Board of Health of San Francisco consists of the Mayor and four physicians appointed by him. Four subordinate officers of health have charge of the executive duties, and one is styled Health Officer, and is Registrar of Vital Statistics. The monthly records and abstracts of the latter are among the best in America. The Health Officer estimates the Mongolian residents of the city in 1873 at 11,000. The census of 1870 found 12,022 Chinese and a few other Asiatics in San Francisco. Though there are few women and children among these Mongolians, the rate of mortality which they suffer proves them to be feeble in constitution and generally less able to resist disease than the Caucasian race. A city that has grown from a coast-trading post to the crowded port which San Francisco is, in the brief

A Summary of Statistical Information relating to Sanitary Conditions in the Chief Cities in the United States in the Years 1873–1875.

City and State.	Total population, census of 1870.	Estimated population, December 31, 1873.	Deaths under 5 years of age in 1873.	Total deaths in the year 1873.	Death rate per 1,000. 1873.	Death rate per 1,000. 1875.	Area of the city in square miles.	Average Altitude above sea-level in feet.	Source and Mode of Water Supply.
New York, N. Y.	942,292	1,040,000*	14,182	29,084	29.08	29.10	22.65 in 1873. [41 in 1875.]	35	The Croton.
Philadelphia, Penn.	674,022	775,600	6,260	15,224	19.64	21.56	122	35	Schuylkill River; pumps and reservoir.
Brooklyn, N. Y.	396,099	435,314	5,539	10,968	25.19	24.78	22	40	Streamlets from south side of Long Island; force and [reservoir.
St. Louis, Mo.	310,864	440,000	4,014	8,551	21.36	14.55	....	475	Mississippi River; reservoir.
Chicago, Ill.	298,977	400,000	5,676	9,557	23.89	18.80	35	585	Lake Michigan; force.
Baltimore, Md.	267,354	305,000*	2,301	7,614	24.96	20.72	14½	60	Rivers; reservoirs.
Boston, Mass.	250,526	276,500	3,289	7,869	28.46	26.18	16½	40	Cochituate Lake and Sudbury River; reservoirs.
Cincinnati, O.	216,239	246,923	2,511	5,641	22.84	20.39	24	575	Ohio River; force and reservoirs.
New Orleans, La.	191,418	200,000	2,562	7,505	37.52	29.13	18	10	Rain, cisterns, and rivers; pumps.
San Francisco, Cal.	149,473	192,000†	1,460	4,002	20.84	18.44	45	50	Mountain streams, distant 15 miles; reservoirs.
Buffalo, N. Y.	117,714	170,000	1,016	2,336	13.74	......	37½	580	Niagara River; Holly system.
Washington, D. C.	109,199	140,000	......	......	......	......	....	45	Potomac River; reservoirs.
Newark, N. J.	105,059	125,000	1,891	3,735	29.88	......	18	30	Passaic River; reservoirs.
Louisville, Ky.	100,753	....	......	......	......	17.20	....	450	
Cleveland, O.	92,829	137,000†	1,431	2,641	19.28	......	31	625	Lake Erie; station $1\frac{3}{4}$ miles from shore.
Pittsburg, Penn.	86,076	133,000	1,781	3,519	26.46	21.12	23	800	Rivers; reservoirs.
Jersey City, N. J.	82,546	167,000*	......	......	......	25.24	....	30	Passaic River, below the factories; high-service reservoir.
Detroit, Mich.	79,577	100,000	1,181	2,506	25.06	19.70	15	580	Detroit River; force and reservoir.
Milwaukee, Wis.	71,440	100,000	1,195	2,026	18.78	......	21	620	Lake Michigan.
Albany, N. Y.	69,422	95,000†	......	1,786	18.80	......	....	85	Ponds and streams; gravitation.
Providence, R. I.	68,904	99,608*	631	1,719	17.26	19.02	15	60	Pawtuxet River by reservoirs and high-service; force.
Rochester, N. Y.	62,386	....	......	......	......	......	....	506	
Allegheny, Penn.	53,180	60,000	772	1,277	21.28	12.70	....	760	Allegheny River; gravitation.
Richmond, Va.	51,038	60,000	889	2,037	33.55	21.84	5	50	James River, private companies, and wells; force and [reservoirs.
New Haven, Conn.	50,840	60,000	580	1,277	21.28	22.29	10	40	
Charleston, S. C.	48,956	50,000†	545	1,516	30.32	32.97	....	8	Cisterns.
Indianapolis, Ind.	48,244	....	......	......	......	......	....	680	
Troy, N. Y.	46,465	....	......	......	......	10.00	....	40	
Syracuse, N. Y.	43,051	....	......	......	15.72	18.55	....	425	
Worcester, Mass.	41,105	48,000	422	1,049	21.85	22.12	34	480	Lynde Brook.

Lowell, Mass.	40,928	50,000	483	1,162	23.24	20.52	8	80	Merrimack River; gravitation, through filter beds.
Memphis, Tenn.	40,226	...	...	...	...	23.06	...	260	
Cambridge, Mass.	39,634	45,000	419	970	21.55	22.38	5	20	Pumped and forced from Fresh Pond.
Hartford, Conn.	37,180	40,000	...	773	19.32	13.04	6½	30	Mountain streams; gravitation.
Scranton, Penn.	35,092	...	...	...	...	7.00	...	740	
Paterson, N. J.	33,579	38,000	433	877	23.08	29.28	8⅓	280	Passaic River; gravitation.
Kansas City, Mo.	32,260	...	...	...	...	...	...	700	
Mobile, Ala.	32,034	40,000	365	1,169	29.22	15.05	10	20	Waterworks.
Toledo, O.	31,584	45,000	277	569	12.64	16.18	12	600	River; waterworks.
Portland, Me.	31,413	32,000	220	691	...	...	...	80	Lake Sebago, 16 miles distant; gravitation.
Columbus, O.	31,274	...	...	...	...	13.60	...	700	
Wilmington, Del.	30,841	...	...	...	...	24.45	...	30	
Dayton, O.	30,473	35,000	206	583	16.66	...	8	750	Mad River; Holly system of force from a great well.
Lawrence, Mass.	28,921	...	...	...	...	27.54	...	70	
Utica, N. Y.	28,804	...	...	...	...	...	...	450	
Charlestown, Mass.	28,323	30,000	...	794	26.47	...	1	30	Mystic Lake, 4 miles distant; reservoir.
Savannah, Ga.	28,235	30,000	...	1,290	43.00	...	...	20	Savannah River; force.
Lynn, Mass.	28,233	30,000	115	642	21.40	20.82	13	100	Ponds; artificial.
Fall River, Mass.	26,766	43,289	...	1,343	31.02	26.17	16	50	Lake; gravitation.
Springfield, Mass.	26,703	30,000	280	654	21.80	21.44	...	50	Springs; gravitation.
Salem, Mass.	24,117	26,000	209	544	20.92	23.10	6	10	Aqueducts; reservoirs.
Quincy, Ill.	24,052	...	...	...	...	15.60	...	464	
Harrisburg, Penn.	23,104	...	...	...	...	14.60	...	250	
Trenton, N. J.	22,874	...	...	...	...	9.10	...	10	
Peoria, Ill.	22,849	27,000	150	309	11.44	13.05	6	440	Illinois River; Holly system.
Atlanta, Ga.	21,789	... ‡	...	...	...	22.57	...	1,050	
New Bedford, Mass.	21,320	...	...	...	...	24.20	...	50	
Poughkeepsie, N. Y.	20,080	23,000	138	372	16.17	26.29	3	50	Hudson River; force-pump and reservoirs.
St. Paul, Minn.	20,030	35,000	298	594	16.97	14.17	15	800	Mississippi River.
Wheeling, W. Va.	19,280	27,000‡	162	410	15.18	17.21	4	675	Ohio River; reservoirs.
Bridgeport, Conn.	18,969	...	...	...	...	13.92	...	10	
Dubuque, Iowa	18,434	... ‡	...	...	...	10.64	...	675	
Chelsea, Mass.	18,547	20,000	177	455	22.75	22.25	5	30	Mystic Lake; gravitation in cement pipes.
Fort Wayne, Ind.	17,718	...	...	...	...	17.52	...	650	
Springfield, Ill.	17,364	20,000	125	404	20.20	16.85	4	600	Saginaw River; reservoirs.
Sacramento, Cal.	16,283	20,000‡	138	403	20.15	...	1½	25	Sacramento River; Holly system.
Terre Haute, Ind.	16,103	25,000	...	326	13.04	13.88	4	450	Wabash River; force.
Elmira, N. Y.	15,863	21,000	114	291	13.86	...	...	860	Streams and lakes; waterworks.
Augusta, Ga.	15,389	20,000	364	714	35.70	20.70	4	600	Rivers and wells.
San Antonio, Tex.	12,256	16,000	100	323	20.19	...	36	600	Springs (a river 2 miles distant); gravitation.

* Annexed areas, comprising their inhabitants, are here included.
† A census in 1875 in most of these cities has confirmed the approximative correctness of the estimations given in 1873.
‡ The annual rate of increase in these city populations is from 1.2 to 2.5 per cent.

period of twenty-five years, must confess the want of some of the means of sanitary security. Deficiency of sewerage and complete house drainage is the greatest sanitary want of that city. Its seventy miles of sewers have not been constructed with suitable regard to sanitary requirements, but the health officer has secured public attention to this want and to the necessity of thorough drainage. The 162 deaths from fevers, — 136 of which were certified as enteric or typhoid, — during the year ending July, 1875, indicate the importance of sewerage improvements and other defences against filth diseases. The almost entire absence of "cholera infantum" in the city, is a fact in evidence of the important relation of vernal heat and moisture in the causation of this remedy. Dr. Logan has said, "San Francisco has no summer climate." The highest number of deaths from infantile diarrhœas in the city has scarcely exceeded one hundred, and never equals twenty per cent. of the rate in New York. The mean temperature in the former city seldom has exceeded 61 degrees Fahr. in July, and, for twenty-five years past, was only 60.84° for that month, and for August was 61.74°; while in our eastern cities, the mean temperature is nearly fifteen degrees higher for the same months. The mean yearly temperature of San Francisco exceeds 56 degrees, while that of New York falls below 52 degrees. Infants under five years constitute only thirty-two per cent. of the total mortality in San Francisco. Pulmonary diseases cause twenty-two per cent. of the deaths at all ages, or four deaths in the 1,000 inhabitants annually. The general death-rate is a little over twenty in the 1,000, but is less than twenty per 1,000 in the white races, and exceeds thirty-two per 1,000 in the Mongolian residents.

Oakland. — The Board of Health consists of the Mayor and four physicians, one of the latter being Health Officer, and another being Registrar of Vital Statistics. Greatly needed sanitary improvements are in progress. Copious water supplies, ample parks, improved outfall of sewerage, and watchful study of preventable causes of sickness are making this one of the most salubrious places. The yearly death-rate has fallen to less than fifteen in the 1,000.

Sacramento. — This city of mining fortunes, at the tidal mouth of the Great Valley of California, suffers special exposure to causes of sickness from the accumulating mass of organic and fluviatile debris which is swept down the valley by recurring floods. Yet, with all its disadvantages of situation, life and health are becoming secure, and when the grading and drainage defences of the city receive attention, and the cesspools and nuisances give place to a correct sanitary system of cleansing, the invasions by endemic and epidemic diseases may cease. The death-rate in Sacramento has, since 1870, fallen from 23 to less than 15 in the 1,000 inhabitants.

The high health-rates of Stockton, Petaluma, and various interior districts of California might be mentioned in this place, for they, like the cities of Sacramento and Oakland, exhibit a record of vitality which vies with that of San Francisco; and from their testimony of vigorous life and of most conservative influences of climate and foods, by which the human organism is developed and fortified to resist the causes of disease, it is not difficult to perceive that upon the Pacific Coast of the United States, man ought to, and probably will, attain very great physical perfection.

THE CORRESPONDENCE AND INTERCHANGES OF THE ASSOCIATION. — SOME DEDUCTIONS FROM THEM.

THE results of correspondence and inquiries conducted in the name of this Association the past three years, warrant some conclusions and indicate certain duties which are important in guiding the efforts of this body for the promotion of sanitary improvements throughout the country. The following facts are here submitted.

The Popular Desire to know how to avoid Disease. — The widespread desire among the people to become thoroughly informed concerning the avoidable sources of disease and premature mortality, is increasing throughout the United States.

Public Economy of Prevention. — Physicians and leading citizens are awake to the economic and social aspects of the duty of public health-care as well as to its humane and moral bearing; and Preventive Medicine now begins to take its position as a branch of Political Economy.

Revision of Sanitary Laws necessary. — In each State in the Union the defects and confusion of the statutes relating to the public health require a complete revision of them.[1] In this respect, the preparation of such a "Digest of State Laws relating to the Public Health," as was designed by this Association when in 1872 its Committee on this subject was appointed, has become more and more a duty and necessity of this body. Already the Michigan State Board of Health has secured the preparation of a Digest of Health Laws in that State.

Why State Boards of Health are necessary. — In each State there is an increasing strength and unanimity of opinion among enlightened sanitary officers and other citizens, that a central or State Board of Health is necessary for the systematic and comprehensive kinds of sanitary inquiry, counsel, and appeal in matters of expert hygienic knowledge and practice.

Expert Supervision of Vital Registration. — The want of thoroughness and of skilled supervision of the registration of Vital Statistics in all (except perhaps two) of the States, and especially the defectiveness and almost utter absence of a correct record and registry of *causes* of death in all the States, are facts which deeply concern the public welfare. Medical men and the best judicial advisers bear testimony to the importance of placing the expert supervision of the registration of Vital Statistics under the direction of State Boards of Health, and in the absence of such a Central Board in any State, all testimony is in favor of organizing the registration, under such other expert control as the State can provide, always subject to the local public health authorities as regards records of the causes of death.

Uniformity in Vital Registry necessary. — Uniformity in the State systems

[1] The health laws of Massachusetts, Michigan, and Minnesota, are exceptionally good, but this criticism applies even to them.

for the registration of vital statistics is demanded on every hand, and this Association is urged to persistent efforts to secure the desired uniformity in as many States as possible, whether the influence of national legislation in its aid is available or not.

Drainage for Health. — The popular belief, and the medical evidence that paludal malaria and the chief endemic sources of disease should be brought under effectual sanitary control, and be wholly prevented by means of publicly directed sanitary works, require that this Association and all promoters of hygiene and economy, shall wisely urge forward comprehensive and effectual works for drainage, sewerage, and the copious supply of pure water in populous communities. Similar demand is being made in all, even the newest, of the States, and in the large towns, that the resources of sanitary science shall be applied under suitable laws, and that contagious, and other avoidable causes of disease and mortality, even the neglected ventilation and cleansing of public places and populous buildings, shall be subject to skilful sanitary supervision.

Exact Study and Records of Epidemics, etc. — The accurate observation of the events and phenomena of epidemics and prevalent diseases, together with the registry of them, is now a public as well as a medical duty which can be made practicable as soon as the leading Boards of Health, the Medical Profession, and this Association, shall agree upon a plan and secure the means for collecting and studying the facts relating to epidemiology and etiology.

Persistent Efforts Needed. — For the promotion of sanitary works that are most necessary and generally desired in our country, it seems important that this Association should put forth comprehensive and most practical efforts to promote the study and effectual applications of sanitary science, the careful investigation of the avoidable causes of disease, the improvement of sanitary laws and the methods of public health service, and the adoption of thoroughly complete methods of registration of vital statistics in all the States.

Unity and Efficiency in Efforts. — While awaiting, yet persistently urging, the proper organization of governmental and adequate official means for complete observations of epidemic and other prevalent diseases, this Association will not rely in vain on physicians and naturalists, if plain and effective methods of voluntary coöperation in this line of duty are submitted to them and such coöperation invited by this body, for the promotion of Preventive Medicine and works for the benefit of public health. Already in this as in other public duties which concern all the people and make them responsible as knowledge increases, the voluntary work of this Association secures a large support from official authorities. This voluntary coöperation of officials is enabling the unofficial promoters of hygiene to aid in giving unity and effect to sanitary works and to a popular knowledge of their importance.

Voluntary Efforts should continue until superseded by Works under the State and National Authorities. — Inasmuch as the work of the Association cannot reasonably be terminated until State Boards of Health and a general

organization of the sanitary service in cities and large towns shall supersede it, plans for patient and comprehensive work are alone suitable for its future; and for this reason the projected sanitary survey and inquiry as now reported by the Committee should be steadily pressed forward to maturity and to the execution of it in the most perfect and useful manner. While doing this, whether aided by national and state governments or not, the Association will not fail in so working, to incite the several States and numerous cities and towns to execute important topographical and sanitary surveys as the first steps in securing systematic drainage, pure and copious water-supplies, and the adoption of measures for extinguishing local sources of disease and mortality.

Interchanges with Public Health Authorities. — The correspondence of this Association with public health authorities, and the cultivators of sanitary knowledge in Europe and other foreign countries, already yields results which indicate both the value and feasibility of international as well as home exchanges of sanitary information.[1] This interchange of results of study and experience based upon comprehensive methods of observation which extend across the continents, which secure exact researches and records relating to epidemics and epizoötics, which also record the latest experience and studies in regard to the propagation, control, and extinction of contagious maladies, and give the results of research into causes of diseases with reference to the control of them, is now sought alike by the hygienists of Europe and America. Upwards of five hundred correspondents in America, and about one hundred in other countries, have entered into communication and a beginning of such interchanges with the Association.

All Nations and Communities have Mutual Interests in the Public Health Questions. — The fact that pestilent contagia which are current on the continent of Europe are current in Great Britain, as Mr. John Simon, of the Privy Council, has said for the latter country, is, in a large degree, applicable in the United States; and while Germany, Belgium, and France are promulgating orders of the State against the possible introduction of the Rinderpest from Siberia, and the *Doryphora decem lineata*, or "Colorado Beetle," from the potato vines of America, — how much more important it is that the united endeavors of scientific hygienists in Europe and the United States should so master the phenomena and facts of the natural history of

[1] *Action by the International Medical Congress in Brussels.* — The section on State Medicine ("Médecine Publique"), at its last session in Brussels (September, 1875), reported upon the question of Organization of the Service of Hygiene as follows, concerning international exchanges of sanitary information, etc.; that such communications should embrace statements of, —

The methods for improving the sanitary condition of localities and populations;

The sanitary measures for removing the causes of endemic diseases;

The precautionary measures taken against epidemics and contagions;

Records of the phenomena and breeding-places of epidemic maladies;

Sanitary measures against epizoötics;

The collection and exchange of sanitary statistics, with the purpose of throwing light upon questions of public hygiene; and,

The periodical meeting of International Sanitary Conferences, to discuss certain previously defined questions, the solution of which shall appear to be practicable.

communicable and destructive diseases, and so promptly and effectively apply the resources of hygiene, that human life shall be protected against such maladies in all countries, and that the commercial intercourse and social interests of every civilized people shall henceforth be unvexed by the perils, anxieties, and losses which have hitherto harmed the community of countries and hindered the progress of civilization.

II.

EDUCATIONAL, SOCIAL, AND PHYSIOLOGICAL SUBJECTS AFFECTING PUBLIC HEALTH.

ON THE RECIPROCAL RELATIONS OF AN EFFICIENT PUBLIC HEALTH SERVICE AND THE HIGHEST EDUCATIONAL QUALIFICATIONS OF THE MEDICAL PROFESSION.

BY STEPHEN SMITH, M. D., NEW YORK.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 12, 1874.

PLINY, the historian, informs us that during the first six hundred years of its existence, Rome was without physicians. This statement is not literally true, for there is evidence that Rome was not without a class of persons who devoted themselves to the healing art. Severe epidemics frequently prevailed, and it is stated that at times there was not a sufficient number of physicians to care for the sick. A more reasonable explanation of Pliny's assertion is that he had reference to qualified physicians, or graduates of the medical schools of that day.

In Greece, medicine had taken high rank among the learned professions, and was respected as a divine art. Its schools were famous for the thorough course of study pursued, and the high standard of educational qualifications required of their graduates. The proper relations of the medical profession to the State were also recognized, and no municipal government was regarded as complete that had not a competent medical element in its administration. Plato, in sketching the model Republic, recognizes the qualified physician as holding an important position among the officers of government. He says: "Is it not necessary to provide good physicians for the State, and must not these be, for the most part, such as have been conversant with the greatest number of healthy and sick people?" It was no infrequent occurrence that cities sent embassies to the leading schools to obtain highly educated graduates to fill the office of Archiatros, chief physician, or medical adviser of the government.

But Roman prejudice and Roman customs excluded educated physicians from the metropolis of the ancient world. The freeborn citizens of Rome had for a long period great aversion to Grecian arts and philosophy, and resisted the introduction of foreign elements into their civilization. Cato, the Censor, expressed the prevailing sentiments of his time: "I will tell

you," he wrote to his son, "when I have an opportunity, what I think of these Greeks, and what I esteem most of what there is in Athens. It is good to study, to some extent, their letters and sciences, but it is not necessary to learn them fully. I shall be done with this wicked and proud race. Nevertheless, be assured, as if a prophet had told you, that as soon as this nation shall have communicated to us its literature, it will spoil and corrupt everything, and this will be so much more easily effected if it sends us also its physicians. They have sworn among themselves to kill all barbarians by means of medicine, and yet they require pay from those whom they treat, in order to gain their confidence, and thus to ruin them more easily. They are insolent enough to call us barbarians, as well as others, and they treat us even more disdainfully by calling us *opiques*. In short, remember that I have forbidden you to employ physicians."

There was some ground for this distrust of Greek physicians, for medical practitioners from Greece frequently located in Rome, of whom, we are informed, "the greater number were only intriguants without instruction or manners, having no other aim than to make a fortune, and capable of every baseness to attain it."

The first attempt to secure competent physicians for the metropolis proved so disastrous as to intensify this prejudice. In the year 535, Archagathus, of Peloponnesus, was invited to settle at Rome, with the offer of the freedom of the city, and a liberal support at the public expense; but he so abused his privileges as to incur the hatred of the people.

Another obstacle to the introduction of the cultivation of scientific medicine is found in the custom which made it derogatory to the character of a freeborn Roman citizen to exercise any art for pecuniary gain. The care of the sick was, therefore, committed to slaves and freedmen who assumed all the functions of physicians. Though many of these practitioners rose to eminence, and acquired great wealth and influence, yet they were never recognized as qualified physicians. There were no laws nor legal restrictions governing them as a responsible class. Pliny, speaking of the impunity with which these self-styled physicians imposed upon the people, complains that they were allowed to practice without undergoing any examination or giving any proof of their ability. "They learn it," he adds, "at our hazard, and acquire experience at the price of our lives. No law punishes their ignorance, nor is there any example of its being chastised. Only a physician can murder with absolute impunity." The historian Renouard remarks: "In the midst of this overflowing of charlatanism the health of the citizens was given over to the first impostor who called himself a doctor, for how could the cheat and usurper of the title be distinguished from the man of knowledge and probity, who had acquired it by study? No examination, no legal proof, was imposed upon any one who wished to practice medicine; there was no security for the sick."

Whether Greek physicians were actually banished from Rome, in common with other learned sects, by a decree of the government, is not material. The historical fact seems well established that during the early periods of the Roman Republic scientific medicine was not cultivated, nor even recog-

nized in Rome. The disastrous results of this State policy appear frequently in the records of her epidemics, and in the complaints of the outrages perpetrated upon the people by the charlatans who overran the capital. Pestilences prevailed in their most violent and destructive forms, and all the measures adopted for their prevention and mitigation were of the most childish and inefficient character. Livy states that, following the advice of the Sibylline books, pestilence was repeatedly stayed at Rome by erecting a temple to Apollo, or to Esculapius, by celebrating public games, or by the Dictator driving a nail into the capitol. Every form of practice was introduced from patriarchal medicine to the most ridiculous incantations. In the absence of all laws requiring special qualifications of those who practiced medicine, and proper restrictions against those who attempted to practice without qualifications, and, finally, proper penalties for those who committed errors in their practice, the greatest abuses prevailed.

The evils of this lax system at length became intolerable, and a reform was inevitable. It required but the stimulus of a public calamity to give shape and character to the reform. This came in the form of pestilence, which swept through the imperial city unchecked by the superstitious ceremonies of the magistrates. The people were awakened to a sense of their insecurity, and to the imbecility of the class of physicians to whom they had hitherto intrusted their health and lives. The measures adopted were as deep and radical as the former policy was superficial and inefficient. The reform began with the enlightenment of the Christian era, and the first step was to invite the representatives of the true art of medicine, the graduates of the schools from which only qualified physicians could emanate; and they were not only invited, but they were installed in places of trust and responsibility in the government. We now, for the first time, learn distinctly of a Medical Officer of State in the Roman Government, under the title of Archiater, an office and title derived from Greece. At first this was rather a position of honor, without very distinct functions. Under the Christian emperors, however, other and far more important duties were imposed upon the Archiaters, and their number was greatly increased.

There were two classes of Archiaters, — one attached to the central government, and the other connected with municipal administration. The first class were designated by the term Palatine, and held rank among the officers of court, and had "at their head a Count or Duke, who was a peer with the higher dignitaries of the State. He bore the title of Count Archiator, or Count of the Archiators."

The second class were called *archiatri popularies*, or popular archiaters. They formed boards or colleges. The number of State physicians was as follows: In the metropolitan cities there were ten; in cities of the second class, or those provided with a forum, there were seven; in the smaller cities there were five; while at Rome their number was equal to the wards of the city. They were not appointed by the governors, but were elected by the people from among the candidates who had given proof of their capacity before the college, and had obtained its approbation. They received a salary from the public treasury; they were exempt from disagreeable employ-

ments ; their property was not subject to taxation ; they could not be summarily brought before a magistrate, and they enjoyed ready means of redress in the courts when insulted or aggrieved. Although required to prescribe for the poor gratuitously, they could engage in general practice, and compel payment for their services. The term of their election and appointment to office was limited only by their ability or disposition to perform their duties. If negligent of their duties their salaries were withheld, and they were subject to deposition from office. If a private practitioner applied for a vacant seat among the Archiaters, he must have studied and practiced under some reputable member of their order, and have been regularly examined and licensed. He must then obtain the suffrages of the public to the vacant seat, and finally must receive the consent of at least seven of the members of the college before taking his seat.

The duties of these boards of State physicians were largely of a sanitary nature. And that these duties were performed with remarkable intelligence and zeal we have abundant evidence. The remains of aqueducts which brought pure water from distant sources to the towns, the well-constructed sewers and drains still in a state of excellent preservation, the public baths, the street pavements, are imperishable monuments of the enlightened sanitary administration which at one period prevailed throughout the Roman Empire. But more conclusive than these material evidences of the progress which sanitary knowledge had made at that time are the reforms which the boards made in the medical profession. In the progress of time it became apparent that there was a vital relation existing between the public health service and the qualifications of those who practiced the medical art. The country was overrun with every grade of practitioners, who for the most part were uneducated pretenders. They not only usurped places for which they had no proper qualification, but the health of the people suffered from their injudicious methods of practice. It was found to be impossible, therefore, to render the sanitary administration effective without fixing a proper standard of medical qualification, and forbidding, by compulsory laws, all practitioners who were not duly licensed.

Accordingly, we find that new and important duties were imposed upon the Boards of Archiatri, or Health Officers. They were required to determine and enforce the course of study pursued at the schools, to examine as to the merits of all persons who proposed to engage in practice, and finally to certify as to the qualifications of each applicant before the magistrates by whom the license was conferred.

Thus that branch of the government which was responsible for the health of the people, naturally and necessarily assumed jurisdiction over the educational qualifications of those whose professional acts directly affected the public health. The sanitary authorities not only fixed the scale of qualification, but they examined every applicant for a license to practice, and compelled each one to attain to the requisite standard. The schools thus became educational bodies, while the sanitary branch of government, on examination, certified to the qualifications of the candidates. But this certificate was not a license to practice. The applicant, with his certificate

in hand, next applied to a magistrate, who granted the license, and enrolled him as a duly and legally qualified physician. By virtue of this license he could practice his art in any part of the Empire, and aspire to the highest medical honors in the State. Without such license he could not assume the character and duties of physician except at his peril.

It is apparent from the preceding sketch that there were two distinct and well-defined periods in the history of medicine in the first centuries of the Roman Government. During the first period we witness one of the most enlightened nations of antiquity, so blinded by prejudice, and so hampered by custom, as to refuse its care and protection for centuries to a science the most humanizing, and an art the most beneficent. The result of such a policy was the enormous growth and extension of charlatanism, the unrestrained spread of pestilences, and the most deplorable oppression of the people. The evils to which this practical banishment of medicine from the State gave origin and support, finally became so intolerable that a thorough reform was inaugurated. This first period is very aptly styled by the medical historian, Renouard, the " *Unlicensed Laity Phase.*"

The second period began with the generous recognition of the value and importance of a science and art which had so long been under sentence of banishment. Scientific medicine was recognized by the State as a necessary element of general and municipal government, and was installed in positions of great responsibility. To its care was committed the highest interests of the people; namely, the promotion and protection of the public health. Most important among these duties was the purification and elevation of the profession itself by requiring a high order of qualification among its members. To the sanitary branch of the municipal government was intrusted the duty of prescribing the course of medical education, and of enforcing, by examination, a suitable degree of qualification. The result of this organization of the profession was most salutary. The illiterate, and unqualified pretenders of every rank and grade, were driven from the country, and medical schools of great excellence were instituted. The medical profession gradually advanced, until it took rank throughout the Empire among the highest orders of society, and even of the nobility. This period is distinguished by Renouard, as the " *Legal or Organized Laity Phase.*"

It is worthy of remark that during the second period there was organized throughout the Empire a most perfect system of sanitary government. This authority was remarkable for its high official character and for the important public duties with which it was charged. In this organization we notice several important steps: 1st. The recognition by the State of a distinct order or class of persons whose duties were intimately related to the public welfare. 2d. The appointment in each city of a given number of qualified physicians who formed boards or colleges. 3d. To these Boards were committed all the municipal interests affecting the health of the people. 4th. One of the most important of these interests was the regulation of medical education and practice. 5th. The formation of a Central Board of State Physicians, having immediate relations to the general government.

In other words, the basis of reform was the recognition of the reciprocal

relations of a well-administered public health service and high educational qualifications of the medical profession. The medium through which the State perfected the reform was the public health service, represented in State and Municipal Boards which were composed of the most competent physicians, and which were fully empowered to enforce the most thorough medical education, and to suppress all forms of irregular and irresponsible practice.

This review of the state of the medical art during the early periods of Roman history conveys a suggestive and useful lesson.

We cannot fail to see in this sketch the more prominent features of the history of medicine in our own country during the past century. Will it not be the duty of some future Pliny, writing centuries hence, to make the statement that, during the first one hundred years of its existence, the Republic of the United States had no physicians! If he were to search our statutes for evidences of the rank and position of the medical profession, as we search the Justinian Code for substantial proofs of the position of the medical profession at Rome, in different periods of history, he would find the highest conception of a physician to which American law had attained at the close of the first century of the Republic defined by competent legal authority as follows: —

"THE TERM PHYSICIAN MAY BE APPLIED TO ANY ONE WHO PUBLICLY ANNOUNCES HIMSELF TO BE A PRACTITIONER OF THIS ART, AND UNDERTAKES TO TREAT THE SICK EITHER FOR OR WITHOUT REWARD."

He might very justly infer from this definition that medicine as a science and an art was unknown in this country, and that medical practice was placed on the same plane as the most common trade. And his conclusions from these data would not only be logically correct, but they would be historically true. The declaration, that any one who publicly announces himself a practitioner of this art is a physician, is equivalent to declaring that there is no class of persons specially qualified to practice medicine, or, in other words, that all persons are qualified who publicly assume the duties.

Before the law, medicine occupies the position of the most ordinary handicraft, and is subjected to the same legal restrictions and obligations. The qualifications of the physician have been and still are regarded as of no greater importance than the qualifications of the artisan or laborer. Indeed, the common laborer can more readily and successfully assume the duties of physician than those of an artisan. He has but to announce himself a physician by posting the word "doctor" on his house, and prefixing it to his name, to legally qualify himself to practice that art, and generally to insure success; but the assumption of the duties of an artisan by simply opening a shop, rarely deceives any community into the belief that the person thereby becomes qualified for new and difficult duties.

While the historian who consulted our statute books might reasonably conclude that scientific medicine had no recognition, and hence no existence, in the United States for one hundred years, our literature and our institutions would give ample evidence of not only the existence of medical

science and medical art, but of its activity. Names of medical men would appear in their annals who received the homage of the people for their great and useful labors. Institutions of learning and charity founded and fostered by medical effort and self-sacrifice would abound. A more rational conclusion to which the philosophical historian would come would be, that scientific medicine secured and maintained whatever rank it held by its own unaided efforts. And such conclusion would be correct. The century which is about to close has been the "*Unorganized Laity Phase*" of the medical art in this country. Ignored by the State, confronted by every form of charlatanry, rejected often by other learned professions, legitimate medicine has maintained its ancient honor untarnished. It has honorably striven to obtain a recognition of its position, and laws have from time to time, and in different States, been enacted which have in some inadequate measure met the needs of the profession. But such legislation has no stable foundation in an appreciative and intelligent governing power. The faintest breath of opposition has at once led to the repeal of laws the most necessary and salutary. So fickle have legislatures proved, in enacting and maintaining laws regulating the practice of medicine, that for the most part the profession has ceased to look for aid or protection from the State. In fact, there has grown up such a feeling of repugnance to all efforts to obtain legislation in the different States, that the discussion of the subject is prohibited in many medical societies. The result of this alienation from governmental protection, has been to create and stimulate into healthy activity in the profession the sentiments of self-reliance and self-help. The profession has manfully struggled to raise the standard of medical education and qualification, and has maintained the most vigorous rules of ethical discipline. But it cannot be denied that these efforts have been comparatively unsuccessful, and that scientific medicine has not attained in this country its proper rank and respectability. The history of medicine in all countries demonstrates how powerless it is to secure more than a mediocre rank when left to its own unaided resources.

Nor is it difficult to discover the causes of failure. It may be stated as an axiom that, whenever the State places a profession requiring expert knowledge for its proper practice (but its real value cannot be fully determined by the people) upon the same footing as that of uneducated labor, such profession will be largely pursued by thoroughly unqualified persons. And the axiom may be supplemented with the statement that such learned profession cannot, in a State which thus ignores it, enforce any suitable educational qualifications. Where there is no legal standard, the schools will be conducted as private enterprises, and the objective point at which their pecuniary interest and their rivalry will aim will be large classes and the largest numbers of graduates. Powerless to enforce a system of education and maintain a standard of qualification, the profession must resign to the schools the entire control and management of its educational interests. Each school, therefore, is at liberty to fix its own course of study, to teach any method it may choose, to determine the qualification of its own candidates for graduation, and finally, to confer the degree of Doctor of

Medicine upon these candidates. The natural fruits of this system are seen in a low standard of education and qualification, and a country overrun with charlatans, some holding diplomas, others ignoring them as worthless, but all *legally* qualified to exercise the divine art of healing.

And this vicious system is inherent in the policy pursued by the State, of refusing to prescribe and enforce a scheme of education and maintain a standard of qualification. The profession cannot rescue itself from this predicament of committing all its educational interests unreservedly to the schools which chance or self-interest may have inaugurated. And it can never be made the interest of schools, thus organized, to adopt a system of teaching, or a grade of qualification for graduation, which will alienate any students because of the thoroughness of the former or the high character of the latter. We believe, therefore, that, by reliance on its own unaided resources, the medical profession cannot elevate itself.

The question arises, a question which has most profoundly agitated the medical profession, and which is to-day of the greatest interest to the American physician: "How can medical education, medical qualification, and medical practice be so elevated and protected as to secure to medicine, as a profession, that rank in community and in the State which its importance demands?" History teaches us that we can only look forward hopefully to the "*Legal or Organized Laity Phase.*" In other words, the only power which can give rank and character to medicine is the State. And by this we mean that the State shall recognize in medicine a science and an art having such relations to the public interests that it must be placed under the surveillance of government. It is apparent that if any State should be so enlightened as to recognize the fact that the medical art, or practice, directly affected the sickness and death-rate of the people, — favorably when practitioners were highly educated in medicine, and unfavorably when they were uneducated, and should thereby be led to forbid, under stringent laws, the practice of uneducated men, — a great step would be taken toward giving character to the practice of medicine. If the State should take another step, and by competent medical authority should fix a high standard of educational qualification for all who engage in the practice of medicine, this calling would become still more honorable, respectable, and dignified. Finally, if the State, under the guidance of the same authority, should take cognizance of the schools of medical education, should prescribe the course of studies to be pursued, and should examine the candidates for graduation, and confer the diploma on the truly worthy and competent, can there be any doubt that medicine would be exalted to the highest rank of respectability, both in society and in the State?

The question recurs, How can the State be brought to a proper recognition of medicine as an essential element of good government? Must we depend upon some devastating, wide-spread pestilence to awaken the people, like that which aroused the citizens of Rome, and made them demand that the long-discarded art of medicine should be installed in the civil administration of the Empire?

In imperial governments, as those of the continent of Europe, this ques-

tion not only admits of ready solution, but has long since been settled. They have recognized the true relations of all the sciences, and regard them as the equivalent of useful and usable power in every department of the State. Every branch of skilled labor is, therefore, not only protected from competition with unskilled labor by vigorous enactments against mere pretenders, but every needed facility is given to secure the most thorough education and the highest qualification of those who enter the ranks of skilled labor. Hence, not only is the unqualified practitioner of medicine debarred from imposing upon communities, but universities of learning are endowed, and every possible encouragement is given to those who select medicine as a profession, to thoroughly qualify them for their future duties.

In this country, however, all is changed. License is the rule, and class distinctions are discarded. Legislation in the interests of any single business or profession meets at once with opposition of the most violent and unreasoning kind. The inalienable right of the individual to do or to be what he pleases asserts itself in the most imperious manner. Every man his own lawyer or his own doctor is an axiom which American education and custom ingrains in the citizen. The result is that no legal distinctions have been, or long will be, tolerated between classes of the people. All legislative barriers which may have been accidentally erected are sooner or later rudely broken down, and whatever sacred inclosure may have been religiously set apart and consecrated to the uses of a privileged order is doomed to be profaned by the feet of the rudest and most uncultivated.

It is apparent, therefore, that coöperation of the State is not to be secured in this country by the same means as in a government where the will of a single intelligent sovereign is alone to be consulted. Mere direct appeals to the people or to legislatures will effect nothing, nor can legislation of an adequate or permanent character be obtained by petition or remonstrance. There must be established in the public mind a fixed belief that their welfare requires the incorporation of certain new powers and functions into the civil administration; and these new powers and functions must, in their practical application, accomplish the reform desired.

Those who have carefully observed the progress of events during the past few years, must have recognized a new element in our political system, which is destined to become a power of no mean import. I refer to the PUBLIC HEALTH SERVICE. In every State in the Union the agitation has begun, which can only terminate in the incorporation of this new element of administration into State and municipal governments. Already in no less than seven States[1] has State medicine found an abiding place in the central government; and there can be little doubt that within a decade of years every State in the Union will inaugurate its sanitary branch of the general government. Nor will the progress of the reform cease with this enlargement of the scope of administration by the State, but every municipality and township throughout the country will have its local sanitary authority.

We recognize in this new element in the State the same power which in the Roman Commonwealth and Empire gave medicine imperial rank. And

[1] Ten States in 1876.

this great and salutary reform was accomplished, as we have seen, not by violence, nor by arbitrary measures, nor yet by intrigue, but by the gradual assumption of duties which the State and people recognized as of vast importance to the public welfare. It requires but little penetration to discover that there is a growing confidence in American communities in Preventive Medicine. The public mind is remarkably receptive of information, and sufficiently prompt to respond to all the requirements which the reform movement may demand. It is in this quick appreciation of sanitary truths by the people that we recognize the strength and permanency of the advancing reform. There will be established in the public mind a fixed and unalterable faith in the power of scientific medicine to protect them from pestilence, whether foreign or domestic ; to discover and remove the causes of disease within and around their homes, and to promote the general health of communities. Such a faith will not be created by mere argument or appeal, but must have for its basis a general enlightenment of the people on all subjects relating to the possibility and economy of protection from disease, and an organized public health service which daily demonstrates the power of preventive measures to fully meet the public expectation and demand. There can be no healthful progress in sanitary reform, and no stable results secured in our form of government, without this public confidence and public faith. And the public health service can never inspire the proper degree of confidence unless it is sustained by medical science and medical art in their highest degree of development. For Preventive Medicine as a science depends upon an exact physiology, pathology, etiology, chemistry, and therapeutics. Without a knowledge of physiology our views of pathology would be incorrect. If ignorant of the causes of the disease, we should not know what preventive measures to employ ; and if chemistry and therapeutics were imperfectly understood, we should not know how to apply the antidote which would destroy or arrest the development of the germ or poison. Every step of progress which sanitary science has made has been by the aid of the medical sciences. Indeed, sanitary science is but an expression of the higher development of the medical sciences ; and history proves that a public health service not organized upon the basis laid by the medical sciences, and not governed or directed by the principles which they have established, is pure charlatanry. It may for a time deceive a community, but it can never gain its permanent confidence. When the trial comes, it will be found to be a cheat and a fraud. A well organized and thoroughly effective public health service means something more than a method by which matters and things offensive to the sight or smell are to be removed or destroyed. It means an organization with every needed scientific appointment, and fully capable of tracing out all the hidden sources of disease, whether confined to the air, the soil, the water, or the food ; in the dwelling, the workshop, or the manufactory ; in the public school or the places of resort. It means that, having found the causes of unhealthfulness, it is capable of destroying them, however immaterial they may be. It means that on the approach of a great pestilence, or during its prevalence, such service can ward off an attack or mitigate its severity, or control and

subdue it. Nor will the duties of a competent health service be limited to the study of the causes of disease and the methods of prevention. It will studiously seek out and correct all those conditions which tend to deteriorate the physical condition of each generation, which impair health, and which diminish longevity. Everything which affects the development, growth, maintenance and long life of the individuals, or classes of a community, fall legitimately within the scope of its inquiry. It is evident, therefore, that the real efficiency and success of a public health service must depend primarily upon the state of advancement of the medical sciences, and the extent to which such service relies upon these sciences.

There is still another more important relation of a higher medical education to the public health service; namely, the application of the medical sciences in the daily practice of the physician. Every professional act affects the health of an individual, and frequently it affects profoundly the health of the whole community. If the physician is ignorant, the patient must suffer, and in proportion as the physicians are ignorant, the public health must deteriorate. It is not a question of what remedies are employed, or what theories of disease prevail, but simply whether the physician is a thoroughly educated, and hence, competent practitioner. In the hands of the qualified, conscientious physician, all remedies are safe, and no mere theory can fatally mislead. How frequently is the patient sacrificed because of a false diagnosis by an ignorant physician! If the total of fatal cases from misapplied remedies, or the neglect of the proper remedy at the proper time, could annually be tabulated, and then faithfully and fearlessly presented to any community, what amazement, what consternation even, such an exhibit would create! And if every fatal case could be so discreetly analyzed as to detect each error in diagnosis and treatment, what a vast percentage of the annual mortality would be justly chargeable to the ignorance of the medical attendants! The country would be horrified at the enormous sacrifice of life through sheer incompetency of those intrusted with the sacred duties of physician, and would realize in some measure the terrible penalties which it pays for allowing any person to be a legally qualified medical practitioner who publicly announces himself "doctor."

Yet the evils of ignorance in the medical profession are not limited to the individuals who suffer from malpractice at the hands of the pretender. The whole family, and frequently the entire community, become the victims of misplaced confidence. The failure to recognize contagious diseases in their incipient stages, and, when recognized, the failure to promptly employ proper preventive measures, has involved many a family and many a community in irretrievable disaster.

It is needless to multiply the evidences that the success of a well-organized public health service depends vitally upon the development of scientific and practical medicine. The question naturally arises, Are these relations reciprocal? Must medical science and medical art rely upon the public health service to secure their highest development and greatest practical usefulness?

We have seen that in the Roman State the public health service and med-

ical science progressed *pari passu* to the highest and most perfect development of each which is known in the history of the race. The initial step was the recognition by the people of the necessity of adequately protecting the State from the devastations of oft-repeated pestilences. They sought relief in the hitherto discarded science of medicine, and in an imperfectly organized public health service. But they early recognized that these two elements, one of the social and the other of the State organization, held mutual relations to the same public interest, and were necessarily dependent upon each other for success in their several spheres of duty. The public health service required that schools of medicine should be established with the most competent teachers which the world could afford, the highest possible grade of educational qualification was required of practitioners, the license to practice was to be certified by an independent board of examiners, and finally all unlicensed practitioners were suppressed. Medicine, on its part, brought to the public health service, and to the care of the sick, men skilled in all the sciences of that day. The sanitary branch of the government of State and municipalities became the glory of the empire, and the medical profession attained its highest rank.

In modern times, England is more correctly interpreting the relations of a well-organized public health service and the highest educational qualifications of the medical profession. A quarter of a century ago, cholera awoke the people of that country to a sense of their want of protection from pestilences, and the Royal Commissions of inquiry into the state of the public health revealed the existence of domestic pestilences far more destructive of life than the much-feared foreign epidemic. An imperfect public health service was organized, which has year by year improved in completeness and efficiency. At its head is now placed one of the foremost medical scholars of Europe, and in the ranks of its officers we recognize the names of the most advanced students of physiology, pathology, chemistry, therapeutics, and the practical branches — surgery and medicine. With the progress of improvement of her sanitary organization, the rank and character of the medical profession has advanced. Largely through the demands of the public health service, England has perfected a system of medical education and registration, having as its directing authority a board composed of the ablest representatives of the medical sciences in that country. Every person desiring to practice medicine in England must prove his qualifications before the proper officer, and be registered, and failing to do this, he is rigorously prosecuted if he attempts to exercise this art. Though the standard of medical qualification has been greatly advanced, yet the sanitary branch of government still demands higher educational preparation of students of medicine as an essential element in the measures adapted to promote the public health. And it can point with infinite satisfaction to the diminishing death-rates of the metropolis and of the country towns and districts as evidence of the value of a highly educated and thoroughly protected body of medical practitioners. And not less important to the future welfare of the nation are those profound and accurate studies of the sources of disease among its people, so ardently and so successfully pursued by her graduates from the higher departments of medical learning.

Standing on the very lowest plane, our public health service immature and unstable, and the medical profession unrecognized and unorganized — it will doubtless appear chimerical if we advance the proposition that the future elevation and purification of the latter will be largely, if not entirely, due to the former. The relations of the two are so intimate that it is impossible for one to advance without a corresponding advance of the other. And that the public health service will become more and more perfect in all the details of organization and administration, all history and our own observation abundantly prove. The hopeful and powerful element in sanitary reform on which we rely for future success is the will of the people once aroused and properly enlightened. Preventive Medicine is always popular with the masses, for it appeals to their highest interest. The impulse which has been given to public thought and inquiry is beginning to bear its fruits. The people listen eagerly to instruction on all subjects relating to hygiene, and everywhere we hear inquiries in regard to the causes and methods of prevention of prevailing diseases; and those inquiries, instead of diminishing, will become more frequent and more importunate. In ten thousand ways these inquiries are answered, and the people are enlightened. The press now daily teems with information in regard to sickness and its causes, and the means of prevention; societies are eagerly discussing sanitary questions, and the occasional visitation of an epidemic serves to intensify the interest, and render the impressions made more and more permanent. There will, we believe, be no retrograde movement in this reform. Sanitary organizations will multiply until the entire country is brought under a well organized public health service. Imperfectly as this service may be administered at first, the tendency will be to improvement, and the forces on which this improvement will depend will be those supplied by scientific medicine. At the very outset of this great reform, therefore, we are justified in the prediction that medical science and medical art are to be, not only the great elements of power on which the public health service must rely to accomplish its mission, but they must be elevated and purified as necessary to the permanent success of the reform.

If this prediction is realized, it is not difficult to forecast the future history of scientific medicine and the public health service in this country. Advancing hand in hand, they will repeat the main features of the history of those two coördinate elements of society and the State in the Roman republic and empire. The State will demand the highest possible efficiency in the public health branch of its administration. But such efficiency can be attained only through the highest educational qualifications of those who pursue medicine as a profession. The sanitary authority of the State must in turn demand and obtain the power to prescribe the course of medical education, to fix the standard of qualification, to enforce such grade of qualification by examination through a competent and independent examining board, to require registration of all qualified persons, and adequate penalties for every attempt on the part of unregistered persons to engage in practice. Nor is this scheme of reform impracticable owing to the alleged antagonism of medical schools. There is no difference of opinion among

medical men, of every rank and shade of opinion and practice, as to the necessity of the thorough education of practitioners in the principles of the sciences. Every school of practice not only recognizes the necessity of requiring of a medical student that he shall have a proper knowledge of the fundamental branches before he assumes the responsibilities of his profession, but, for the most part, they teach these branches in the same manner, and from the same text books. If, then, all classes of practitioners agree as to the necessity of a curriculum, embracing the foundation studies, as anattomy, physiology, chemistry, and the principles of medicine, surgery, and obstetrics, there can be no obstacle to the "one portal" plan of entering the medical profession. The schools of every class would then assume their proper position and functions as educators, while the State would protect and promote the public welfare by guarding at the "portal" against the entrance of unqualified men into the ranks of the guardians of the health and lives of the people. When these reforms are effected, medicine will assume its ancient position in society and in the State. Purified and elevated, it will again be regarded as a "divine art."

May we not hope that, with the close of the first centennial of the Republic, we shall witness in the history of medicine in the United States the close of the "*Unorganized Laity Phase*," and that with the commencement of the second century we shall recognize the beginning of the "*Legal or Organized Laity Phase?*"

HEALTH AND THE HIGHER CULTURE.

By Samuel Osgood, D. D., LL. D.

A DISCOURSE BEFORE THE AMERICAN PUBLIC HEALTH ASSOCIATION, PHILADELPHIA, NOVEMBER 10, 1874.

A great many definitions of the modern man have been given, and a catalogue of them would make a curious and interesting document. Some definitions rest upon superficial distinctions, and some go more into moral and intellectual characteristics. It has been said by a brilliant writer, that pantaloons distinguish the modern man above his predecessors of the toga, and that the era of pantaloons is the date of his emancipation, while others affirm that the modern man as such is a democrat, and that he thinks and acts for himself, and is master of the ballot and the bullet by virtue of the revolver and universal suffrage. I will not try to add to the number of exhaustive definitions, but will be content now with maintaining that the modern man, more positively and more generally than his predecessors, needs peculiar health for his essential and higher education. It may be that a select class in ancient and modern times were placed in circumstances very much like those which surround us and task our nerves and try our composure. Demosthenes and Pericles, Cicero and Virgil, Bernard and Dante lived, like ourselves, probably, more in their nerves than in their muscles, and were subject to much of the agitation that belongs to our current life.

But now the multitude of mankind are coming to a certain extent into the conditions of the literary class, becoming readers generally, and thinkers to a certain degree. We have no longer merely the proletary class whose business it is only to vegetate, nor the merely military class whose business it is to fight, nor the merely drudging class whose business it is only to work. We are all more or less taking the affairs of the world upon our own shoulders, and carrying its problems in our own heads. The workman's blouse is often made to cover as earnest a thinker as the professor's gown; and the railway, the telegraph, and the newspaper are everywhere, and everywhere making men and manners new, or, if you prefer the word, modern. We may observe a peculiar *agitation* in our current life, and what we call the news — that mighty and generally troubled tide — goes everywhere, and brings every man's brain into immediate contact with the whole stir of the race in such a way as to craze weak hearts and paralyze sensitive nerves. Then, too, our modern society is very *exacting* in its demands, and tends to increase our wants more than it increases our powers, carrying everywhere the love of luxuries and the taste for refinements, without carrying to the same extent the arts of industry and the powers of acquisition, giving to many men habits of expense beyond their available means, and nurturing in

most women susceptibilities and aspirations wholly out of proportion to their ability and their prospects. Add to this general *agitation* and *exaction* of modern society, the *unsettling* of the established faith and institutions, the assault upon all belief and all loyalty, whether in marriage, civil government, or religion, — and we surely see tendencies at work which make the lot of the modern man peculiar, which endanger his peace, his efficiency, and his fidelity, and call for an education of body and of mind in keeping with the needs of his time and his position.

We are in danger of becoming a nervous, uncomfortable, discontented, wretched race, unless we use our best thought and effort to bring the highest wisdom and virtue and order that are within our reach to bear upon our way of living. Hence the excellence of this American Health Association that now calls us together — where, indeed, I ought to be a learner rather than a teacher, and where I could not presume to open my lips, were it not that these learned doctors, who know so much more of the matter than I do, ask me to say something from my own point of view. Instead, then, of invading their territory, and parading my ignorance of the great science and art of medicine, I will be content to stand upon my own ground, and to treat of health and the higher culture as a man — who has been a preacher and pastor and general scholar — may be supposed to know the subject.

Strictly speaking, health is a part of the higher culture, for body and mind are practically inseparable, and we know nothing of the sound mind apart from sound blood and brain. I am willing, for the present purpose, to take Herbert Spencer's definition of life as the basis of our discussion, and to allow that *life is the continuous adjustment of internal relations to external relations*, if by external relations we comprehend those which are social and religious as well as those which are physical. If life is the continuous adjustment of internal relations to external relations, then healthy life is such adjustment truly and fully carried out, and he is the healthy man who lives in true relations with nature, man, and God.

I. Now what we want first of all in our care of health, as related to our higher culture, is such a condition and use of the bodily senses as to enable them to provide the mind with all that it needs from the kingdom of nature over which the senses preside. The mind needs to take in the light, and strength, and sweetness of the universe through every sensibility and organ of our being, by touch, and taste, and smell, and sight, and hearing, and I have no objection to add what the new philosophy calls the three added senses of musculation, calorition, and electrition. Whatever may be the mystery of the soul or of the spirit in man, our schooling must come through the senses, and the more quick and inspired is the mind in proportion as the senses are open wisely to the facts and forces of the universe.

We must touch substances to learn reality, and to know distances, and to be conscious of our own will. Certainly the proper training of the touch is a great part of education. We must taste food and drink, or we starve and die. What a world of culture opens here upon us in this matter of eating and drinking. In fact, cooking is the most important part of applied chemistry, and wisdom and virtue end where dyspepsia begins. It is well

that the schoolmaster is abroad; but he walks and teaches in vain if the cook in the kitchen does not fit his scholars for their place at school; and if, while God sends grain and meat, the devil sends cooks, as he often seems to do, even in this nineteenth century. We want cooking suited to the stomach and brain of the modern man, such food as will leave the brain time and freedom for its peculiar work, without having its exquisite powers called down into the deeps of the stomach by bad bread and meat, saleratus and grease, to do the work of digestion to which the boa-constrictor devotes himself, without having any higher service to perform. How much of thinking or no thinking, how much ignorance and folly, bad temper and utter despair, come from cooking and its familiar imp, dyspepsia. I commit this subject to the consideration of the American Health Association, and of the whole American people, quite sure that this materia hygienica is important as the materia medica. Our vices and our follies come in great part from what goes into our mouths, and the sword and gun are not such destroyers as the trencher and the glass. What a commentary upon the higher culture is our use of two products of the soil — spirits and tobacco. Great has been the power of the sceptre and the crozier, the sword and the pen; but in our day the pipe and the bottle are likely to beat them all, and it may be that if the proverbial New Zealander ever comes to see London or New York or Philadelphia dismantled and depopulated, he may find there among the majestic ruins the instruments of their overthrow, and the symbols of their downfall — the pipe and the bottle, or the cigar box and the whiskey cask, that have stupefied the senses and distracted the wits of the race extinguished by their might.

The face and front of man turn toward the earth and the heavens in search of their appropriate aliment, and we feed not only upon what we eat and drink but upon all that we see and hear. We need to take in and digest the real sights and sounds of nature and art, or we pine away from lack of the elements of the higher culture. It is a wretched mistake to believe that second-hand impressions are enough, and that words and mere descriptions of nature and art will do well enough without the reality. As well say that descriptions of apples and wheat, of fish and game, of beef and mutton are as good to eat as the real growth of the fields and the waters. The great mistake of our scholastic training, from which we are now emancipating ourselves, is the taking of words for things instead of taking words from things, and we have been living and feeding our children upon mere verbiage instead of upon the facts of nature and life. The direct contact of the senses with real things; the sight of rock and tree, bird and beast, forest and river, star and mountain; the hearing of the music of creation in every voice of wave or wind or song or speech — this is health of body and mind, and lets us into the life and blessing of the universe. The process as well as the instruction is healthy and inspiriting, and it makes us all sprightly children in the Kindergarten, and not droning drudges in a prison-house, away from the green grass and the sunny skies. Undoubtedly, one great reason of the loss of power over men by the class of modern scholars has come from this want of a firm hold upon reality, and the chicken-chested, lantern-jawed,

shad-bellied, spider-legged race of Dominie Sampsons of every grade have been distanced not only in the senate hall, but even in the school and academy, by a new race of men, who have seen the kingdoms of nature for themselves, and brought the life of the woods and waters, the field and the mountain, into their breath and pulse, their pen and their voice.

Great health there is in nature, and in the art that is true to her; and the masters of her lore have been generally rare examples of health of body and of mind. The great naturalists have been long-lived men, and what is more remarkable still, while the poets of human passion tend to burn themselves out in the fires amid which they live, the poets of nature who have studied the universe in its unity as well as in its variety, and sought to breathe in the higher life that pervades its kingdoms, have been remarkably healthy and long-lived men. What lessons thus speak to us in the career of Goethe and Wordsworth, octogenarians both; of our own Bryant, who completed his eightieth year but a week since. How nobly his lines to our America —

> " O Mother of a mighty race,
> Yet lovely in thy youthful grace," —

speak to us now as we interpret them in the call of our country to the higher education of her children in keeping with their magnificent heritage:

> " For on thy cheeks the glow is spread
> That tints thy morning hills with red;
> Thy step — the wild deer's rustling feet,
> Within thy woods, are not more fleet.
> Thy hopeful eye
> Is bright as thine own sunny sky."

II. Thus we are led to insist upon the importance of carrying up into the higher being of men the light and nurture that come from healthy relations with nature, and to believe that we greatly relieve the *agitations* of our modern life by the calming truth and beauty that reason and imagination derive from this true use of things. We go on now a step, and affirm that our higher education needs the tonic energy, the solar force that full health gives, and that this health, instead of resting merely in the muscles and building up the animal man, should be carried up into the brain and be made to serve the spiritual power, the mysterious will that is enthroned there by the Creator's hand. The superior culture needs not only the calm base, but the working force of healthful relations with the universe and its kingdoms, in order to meet the peculiar *exactions* of modern society.

Here our schooling has been sadly deficient, and in some respects it is becoming more so. It has depended too much upon diet and too little upon exercise; and the diet has been practically poor for want of true exercise; cramming with words has spoiled the digestion without stirring the limbs and the will. The best knowledge has not been given, nor would any knowledge, in the merely intellectual sense of the term, be true education. Knowledge is not power until applied by force, and our current education is wanting in force. Science, indeed, cannot be pursued without a certain force of will, and the men who are to observe the coming transit of Venus, carry resources, and present powers of limb, and sense, and will, that might

fight battles or build cities or reclaim deserts. But to skim over the record of their preparations or the results of their studies, which generally passes for knowledge, amounts to very little, and much of our schooling and reading is of this kind, and has little to do with force of character or strength of action.

Knowledge of itself is not power until carried into action. Science amounts to little until it goes into art. Even astronomy, the most sublime and independent of sciences, needs art to make its telescopes and use them, and art to note and record and classify and reduce to law their careful observations. There is no art without action, and no action without force. When Demosthenes said that eloquence was action, action, action, he meant to say not that it was mere gesture, but that it was living force, action in word and look and movement, from the full play of the life within. Is not all true art action, and must not all the business of mankind, whether in the arts of use or of beauty, if well done, be action? Whether we build a house or make a statue, whether we sail a ship or paint a picture, whether we sing a song or preach a sermon, must we not put action into it, the best force that is in us, and that can go out from us?

There is, undoubtedly, a mystery in the art power, whether in common business or in works of genius, and it cannot be made to order. But we may be sure that it depends largely upon healthy conditions of body and mind, and that the will power may be built up by healthful relations with the solar forces in nature, and may be carried up into the inmost chambers of the mind. Cæsar undoubtedly was a better writer and speaker, because he had been a soldier, and could put into his pen in his Commentaries the point and the fire that he had won from his sword in his campaigns; and David was a greater poet, because the hand that touched the lyre had grappled with the lion and the bear, and hit the Philistine on the head with a sling as unerring as the words that have reached the heart of the race, and will reach it evermore. If words are battles, it is because of the heroism that is in them; and surely every great fight, whether at the point of the bayonet, or of the pen, or of the tongue, is carried by force, and not by theory or sentiment — force of some kind, force that is not dreaming, but doing; not mere talk, but brave action.

Our schools and colleges need to find this out, and a large part of the great and growing disappointment of what are called our educated men comes from this source — the want of practical force corresponding with speculative ideas and sentimental aspirations. They find it very hard to get a living, and perhaps they will find it harder still. Indeed, a large part of the more susceptible and exacting class of society find more difficulties in the way of success than they expected, and they see the up-hill road rising before them when they thought that they had reached the top with its easy going. Hard work is still the lot of men, whether with bare hard hands or in kid gloves, and we are not only to return to solid specie payments, but to solid labor; not only to take the inflation out of the currency, but the gas out of ourselves, our fancies, and our living. The higher the education, the more earnest should be the work, the more intense the action, and the more thorough the training.

We need kings and princes of the true kind, not to tread us down, but to help us up and keep us up; not to spend our money, but to save it; not to set the fashion for our follies, but to rule over our utilities, and to give the brave word of command for our progress. The civil service reform must be carried everywhere. Shirks and drones and ninnies must be put aside, and their places filled by men who know what to do, and can and mean to do it well. In every department of life — in work-shops and stores, on farms and railroads, in homes and schools, in all business and all government — we need kings of action; and while the old empires are eying royalty pretty sharply, and it does not take much to turn out an idler or a spendthrift from a throne, our Republic should be no less exacting, and should insist upon having the right men in the right place everywhere — the men who can do the work of office, and who are not merely greedy for its spoils. Health must be back of this true service, and has had much to do with its triumphs. The laws of health marched with King William and his son, with Bismarck and Von Moltke to the Rhine; and diet and exercise, quite as much as the rifled cannon and the needle-gun, fought the battle of Sedan, and changed the face of the world.

More of this true power we need in our America. We, as a people, are more imperial in our expectations than in our performances. Our young men know how to spend more money than they can earn, and our young women too often feed their ambition upon romantic fancies, and fill their stomachs with enfeebling trash; they dream of fortunes and palaces, and do not know how to make a shirt or a loaf of bread, to nurse an invalid or to tend a baby, to train a child or rule a household; and sometimes they crave the jewels and orange blossoms of the bride, and repudiate the duties of the wife and the destiny of the mother; and the race in some quarters is in danger of dying out because of this repudiation of the queenly dignity and fidelity of the sex.

In every sphere we need the superior force, the supreme energy of the educated will to meet the call of the hour. So only can we become free, and this will, born of God Himself, and drawing forces from the whole universe by healthy exercise, becomes the motor power of the imperial reason, the right hand of intelligence, even as the Divine Spirit is the finger of God and the messenger of the coeternal Word. This power we cannot abdicate without surrender of our birthright and betraying our trust. No mechanism, however ingenious or mighty, can take its place, for all machines come from the brain of man, and are subject to his hand. Steamer and locomotive, telegraph and power-loom, microscope and telescope, the knife that heals and the sword that slays, the rifled cannon that covers the field with the wounded, and the ambulance that takes them in mercy to the hospital — all these are subject to the hand of man, and depend upon his will for their true use. All instruments are but apparatus for man's fingers, tools to his will, and in a certain sense extensions of his touch. Then train that will wisely by the best diet of nature and life, and the best exercise of art.

III. So we come to our last point in our estimate of the bearing of health

upon the higher culture — I mean the habit of order and its basis in the laws of health and its periodicity. Here we are called to meet the *unsettling* tendencies of our time, and to try to settle the people down upon the true rule of living, before we can hope to settle their opinions as to the contested points of speculation. This, perhaps, is the important work now to be done by thinking and practical men. While the fight is going on between science and theology, practical philosophy should learn and teach us how to live true lives, and when we obey the just laws of living, we shall undoubtedly be in the way of seeing better into the nature of things, — natural, human, and divine. Here the great question opens upon us, What are the proper habits of a healthy, highly cultivated man in his relations to his own constitution and to the universe of things and beings in which he dwells? The mediæval church undertook to settle this whole matter for all and forever, and the Roman Catholic calendar and creed, pulpit and confessional, claimed to fix the basis and the movement of human life; and its altar set forth the absolute history and the absolute law for all souls in what may be called the Epos and the Ethos of the Christendom of that time. It is not my aim now to criticise that system, or to go into any theological controversy; least of all, to quarrel with the Catholic Church, Old Catholic as I claim to be. But it is very clear that modern thinking is getting into all churches, revising old rubrics and adding new. The old style of sage and of saint has gone by, and devotees no longer admire the typical ascetic of the past in his rags and dirt, skin and bones, without children, and away from homes and men, measuring sanctity by his absence from the world, and calling life heavenly in proportion as it became unearthly, and making man out to be the more godly as he was less human. This style of saint has gone by, and the doctors of medicine have a great deal to do with dismissing him. Those doctors have been making their mark upon opinion and life, preaching from a powerful pulpit of their own, and hearing more confessionals in our time than the clergy. Once the priests were physicians, now the physicians are becoming, in their way, priests, and giving laws not only to their own patients, but to society, and revising the rubrics and shaping the Epos and the Ethos of the race. The Pope himself takes modern medicine, and has a modern cook, and seeks health as the doctors advise.

What a confessor the skillful physician is, and in how many tongues he hears confessions! Rome hears her penitents tell their sins in a score of tongues in her great cathedral; but the physician hears the murmurs of contrition from a harp of a thousand strings in a temple which is the universe in miniature, and to his practical ear or eye or touch, every beat of the pulse, every throb of the temples, every quiver of the lip, and every tremble of the tongue, every twitch of the muscles and tint of the cheek, every temper of the hand and hue of the eye, tells the unspoken secret of the life. No march of science threatens this confessional. Let the physician, then, be true to his priesthood!

Let our doctors do their work well, and the doctors of theology will have no cause of quarrel with them. We need a thorough study and application of the laws of health to the whole habit of the individual and of society.

We live by diet and exercise, or by what we receive and by what we do or give out, and upon the just relation between these two functions, or between receiving and giving, — the sound method of life, the true order of habit depends. The recent studies of the human constitution, the coördination and sequence of its senses and faculties, the harmony and the melody of its many strings, throw great light upon the true laws of living, and have done much to revise the practical code of men. We learn from them as never before that there is a law of combination and of continuity in our being as in music, and that certain functions go together, and certain functions succeed each other, while, throughout all these simultaneous and successive changes, there is a certain basis of constancy which we are always to observe and guard. Take our stand upon the constant fact of the human constitution and of the laws of the universe — we are to ask how the true simultaneous and successive changes are to be guided. We cannot do or receive all things at once; what forces and sensibilities shall we try to move together, and what shall we hold in reserve for the proper time and place; what receptions and movements belong to the hour or the day, and what are to be distributed through the week, or month, or year, or decade, or the threescore and ten years, or eternity? Here the great law of periodicity opens upon us, and the doctors are to do their part to teach us to understand it — how to combine, and to continue work and rest, diet and exercise, labor and play in wise proportion, and to give to life the best possible constancy and variety. The health laws will be found to act powerfully upon the higher culture, upon the intellect and will, upon the affections and the imagination, and to win new joy to the spirit as the life of nature is more wisely studied and obeyed.

It does not do to play upon one string or upon all the strings of life at once, or all the time; and judicious combination and sequence make the music of the man as of the harp. The trouble with us is that we make the sad mistake of both these extremes, and while with some life is one-stringed monotony, without change or recreation, with others it is many-stringed dissipation and distraction, without rest or reserve. We are greatly in need of the true philosophy here, and many of our foremost men die before their time because they do not have due change as well as rest, and do not add to their vocation a proper avocation. Business men, full of strength and ambition, who lived between work and festivity, — the day given to the clink of dollars and the evening to the clink of glasses, — have fallen before their threescore years and ten, often before threescore, by thousands; while they who add to the work of the counting-house or of the study the daily walk or drive, the care of the farm or garden, live long lives, and the days and years sing to them, as they roll on, in health and joy.

Perhaps one reason of the undoubted fact that the clergy, especially the regular, well-educated Protestant clergy in Europe and America, are the most healthy and long-lived of any class of men, comes from the fact of the just combination and sequence of their lives. They study in the morning, and make visits generally in the afternoon, and they add to frugal living kind sociality and judicious recreation. They marry generally for love, are

free from the perils of poverty and of riches, and they combine much of the new culture with devout faith and service. Their record is an honorable one, and the old pastors and preachers have practiced as well as taught a wisdom that may not always be found with the new sensationists, who are likely to pay for their spasmodic brilliancy by burning out before their time.

We are to try to embody the lessons of such wise living in something that approaches to a social code, and we are to have a better understanding of the manners and customs that belong to our race. We cannot probably change essentially for the better the ancient year of faith, and science does not destroy, but deepens the record of the Incarnation which is at its basis; but we can justly modify the life based upon the old calendar by making more account of the calendar of nature, and the best use of the body as well as of the mind. We must keep the old Christmas, and may deepen its joy by reforming its revels. We may keep the old Lent, yet revise its asceticism, and learn how to starve out the devil without weakening the proper man or mortifying the good angels of God around and within us. As students of health we are to appreciate anew the needs of popular recreation, the worth of gardens, parks, music, pictures, sculpture, architecture, poetry, eloquence; and as the old game of war, we hope, is to make up less of the excitement and public life of the race, we may trust that the arts of peace will put forth new power and attractions, and that mankind will learn that they may sing and dance and march and rejoice together without the call to battle or the triumph over fields of blood. Yet we can keep the trumpet and the drum, the fife and the bugle, as well as the flute and the harp, while we live in peace with all men, and ask to be led by the Gospel of love to do the great work of humanity, to lift the burdens from the wretched, and to put away the ills that darken the world and curse the race.

So we shall have our true human joy, and the laws of health must be at its foundation to make the body serve its master, the mind, in the individual and in the race. The philosopher Comte, full of sagacity in spite of his frequent extravagance, has said that "the brain is a double placenta permanently placed between man and humanity." There is great truth in this, and we do much to bring man into true relations with his race by the due care of the blood and the brain. Let the doctors of health do their part toward this result, and they will find that they are helping on the higher work of humanity, and solving the highest problems of life and mind. True joy with true wisdom will come from this work, and the root of doubt will be taken out by the light and force of life.

This is not, indeed, the spirit of much that passes for our higher culture, and some of the saddest voices of our age come from our most highly educated and accomplished men. What a lamentation is that which has lately come from one of the most learned and brilliant minds of Germany, the invalid philosopher of Berlin, who, at thirty years of age, has written the most conspicuous and popular metaphysical book of the last decade—Edward von Hartmann, of Berlin. He says that the youth of manhood has

gone and died with Greece; that we are a cursed and failing race, and extinction is our only hope, death the only salvation. As I speak of this invalid Pessimist, I cannot but think of three men of eighty years with whom I have had close relations, and whom you know well, — three Americans, eighty years old this very year, who speak a different language, and have no creed of despair, — Orville Dewey, James Walker, William Cullen Bryant, the orator of religion, the philosopher of conscience, and the poet of nature, — so unlike in gifts, yet so like in spirit and life! I present them to you to receive your honor in return for their blessing — the blessing of fourscore years of their experience and of God's providence. They are full of faith and charity, of wisdom and joy. They have a kiss for little children, and a blessing for the green grass and the tender flower. They can see God in the stars, and find hope of heaven in the heart and conscience that attest the truth of the immortal life within. They are younger than old Greece ever was, and are ready to enter the kingdom of heaven as a little child. Health has joined with it higher culture to give them their age and their joy.

So then let us put our heads together, and do our best for ourselves and our race. More light, better air, good clothing, homes, exercise! So also more true life, more faith, charity, wisdom, justice, piety! Spinoza, whom many call the head of modern culture, said that healing or salvation comes from man's being in harmony or at one with the universe; and there is wisdom in that saying. A greater than he has said that healing or salvation comes from man's being at one with God, and that to know Him truly is life eternal. Why separate the two thoughts? Why may not medicine and theology agree to say together that healing comes from man's being at one with the universe and with God? And let all the people say, Amen!

INFANT MORTALITY IN CITIES.

By Henry Hartshorne, M. D.,

Professor of Hygiene in the University of Pennsylvania.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 10, 1874.

It is, in my belief, a justifiable opinion that amongst those born with a normal constitution, and under entirely favorable circumstances, the mortality during infancy and childhood *ought* to be *less* than at any other period of life. Yet it is a fact familiar to every one, that the reverse is the case in very many localities, most notably in large cities. In France, according to Bouchut, one sixth of all born, die in the first year of life (Bertillon recently puts it at one fifth); in Sweden and Finland, one fifth; in Berlin, Prussia, one third. Nor is the proportion very much less in some parts of England and this country. Before the war it was worst of all in New Orleans. In 1872, 1 death in 4½ occurred under one year of age in that city.

In New York, in 1868, as reported by the Metropolitan Board of Health, more than one fourth of the total mortality was of children under one year of age; while in *certain districts* of that city 80 per cent. of the whole mortality occurred during childhood. In 1872, considerably more than one in four of the deaths in New York occurred in children one year old or under. Philadelphia suffered last year (1873) a total mortality of 16,736 deaths at all ages; of which 5,121 were under one year of age; and 7,151, about 1 in 2⅓ of all deaths, under five years. Yet this was below the infantile mortality of our city for the four previous years. Boston, in ten years (1861–70) lost within the first year 1 in 5¼ of all born. San Francisco, in 1871, had 1 death under one year of age to about 4⅓ of all deaths. Looking back through considerable periods, we find that in 1810, in New York, one half of all deaths took place in persons twenty-four years old or upwards; in 1857, one half of the deaths were of children not more than two years old. In Philadelphia, in 1807, half of the deaths occurred after twenty-four years of age; in 1856, one half were of children less than four years old. These last figures show an *increase* of mortality, relatively at least, amongst children. Dr. Farr has shown that in London it has been otherwise. About the middle of the eighteenth century, 75 per cent. of the deaths were of children under five years of age; at the beginning of the nineteenth century, about 50 per cent.; and now about 29 per cent. have fallen within the same period of life. The rate is declining somewhat during the last few years, in Philadelphia and New York. From 1860 to 1872, the deaths under five years were 44.78 per cent., and under one year 27.25 per cent., of the total mortality of Philadelphia.

In England, Dr. Farr proves by his reports to the Registrar General, that the diseases of childhood are *twice* as fatal in towns as in the country. Other interesting points are, as to the season of greatest mortality of children in our great cities, and the nature of the most destructive maladies. As Dr. Elisha Harris has remarked, summer is the *tentator infantum* in New York. In the summer quarter of 1868 in that city, the whole number of deaths being somewhat less than 8,700, of these nearly 5,600 were of children under five years of age; almost all being from what are called "diarrhœal diseases." During one hot week of the summer of 1870, three fifths of the aggregate mortality in New York (645 deaths out of 1,068) occurred in children under five years; 400 deaths being from cholera infantum alone. In the hottest week of 1872, in Philadelphia, 852 deaths occurred; of which 497 were of infants under two years, 383 under one year; mostly from diarrhœal disorders. The week previous to this gave 1,569 for the total mortality of New York, increased largely by the same mode of causation; such an aggregate of deaths probably having never been exceeded in that city; as the former (852) never has been in Philadelphia.

But the excessive mortality of early life is by no means accounted for by seasonal influences alone; other causes, also, are of great importance.

These may be advantageously referred to as *ante-natal* and *post-natal* causes. Under the former head belong constitutional defects in parents; resulting especially from *alcoholism*, *syphilis*, *scrofulosis*, debility from *overwork and under-feeding*, in the poorer classes; in those more prosperous, excess of the *nervous temperament*, and *deficient organic development in women who become mothers.*

Upon *alcoholism* as promoting brevity of life in offspring, it is not necessary now to dwell. It has been proved to be a very direct productive cause of disease, especially of *developmental* diseases. Drunkards' children are often idiotic, deaf-mutes, or blind, or epileptic, or they die early with convulsions; showing radical constitutional impairment.

Syphilis has been credited with a very large infantile mortality. Dr. Sturgis, in the "American Journal of Syphilography," is quoted by Professor Gross[1] as asserting that to it are due 80 per cent. of the deaths of children under five years of age, in New York and Philadelphia. I cannot believe this to be an entirely correct statement of either city; certainly it is not so of the last named. Still, as a contributing cause, no doubt syphilitic taint of constitution, along with many instances of destructive congenital syphilis, has large influence. That syphilis is in any sense or manner the parent of scrofula, does not appear to me to be at all probable. The two are, under observation, quite distinct diatheses, though combined in certain instances; and it is to be inferred that they have always been different, in origin and nature.

Scrofula, seems to be less frequent now, in Philadelphia at least, than thirty years ago. It is likely that, with us, improved general hygiene and medical practice may have had to do with this change. This is not the place to consider the question whether scrofulosis and tuberculosis are or

[1] Address in Surgery, *Trans. of Am. Med. Association*, 1874.

are not one, and whether or not phthisis is essentially a tubercular affection. My belief is that struma and tubercle are modifications, only, of the same diathesis. Consumption of the lungs is not common amongst children in our American cities ; it is more so in those of Great Britain and on the continent of Europe ; but other forms of analogous or related disease destroy, through *marasmus*, *tubercular meningitis*, etc., a large number of the young, here as well as elsewhere.

I have spoken, amongst the causes of early mortality acting through parents, of excess of the *nervous temperament*, and *deficiency of organic development* in women. It might be safe to say in *men and women*. Both *run to brain and nerve* too much, in this country. Animal functions are less readily subordinated to the intellectual and moral nature, but all these rob too largely the vegetative, nutritive, and reproductive systems. This, I believe, to be the secret of the lessened and lessening number of births of American children of native parents, compared with those of foreign parentage. Much more remains to be investigated upon the subject, notwithstanding the elaborate inquiries of Dr. Allen, Dr. J. Stockton-Hough, and others. In Massachusetts, at least, the mortality of infancy is greatest amongst the children of foreigners.[1]

Post-natal causes of infantile mortality differ in different climates. Northern cities lose many infants in the winter, by pneumonia, capillary bronchitis and croup — under the exposure to cold so often connected with poverty and neglect. Dr. Farr has shown that in London, the degree to which the thermometer descends in December, January, or February, determines to a great extent the mortality of the winter. Sir Thomas Watson asserts the mortality in England to be always larger in winter than in summer ; unless under the influence of occasional epidemics. This last observation, however, will not, as has already been shown, hold true of our large cities, in this country.

Drs. A. Mitchell and Alexander Buchan have stated that, in London, the weekly mortality shows a large excess from November to April, falling to its minimum at the end of May, rising again nearly to the maximum in July, and then going down until October. In Victoria, Australia, the mortality and temperature rise and fall together throughout the year. In New Orleans, in 1872, the largest number of deaths occurred in young children in May, June, and October. In San Francisco, the greatest total mortality, in 1870–71, was in the months of October and November.

Nothing in our mortuary statistics in Philadelphia and New York is more constant, than the proportion between the number of deaths amongst young children and the excess of the daily temperature above 95° Fahrenheit in the shade ; indeed, we might safely say, above 90°. But, along with this positive cause of disease, taking effect most severely upon the infant population, must be apprehended and remembered also the action of *impurity of atmosphere*. Cholera infantum is very greatly promoted and made fatal by this cause. So also are those disorders of the nervous system which end in convulsions. And this is, I doubt not, almost equally true of some

[1] *Massachusetts State Board of Health Report*, 1873, p. 215.

affections of the colder season; as pneumonia, bronchitis, and croup. In adults it has been well established that *close living* is a powerful promoter of bronchial and pulmonary inflammations, as well as of phthisis in all its forms.

Every zymotic disease is rendered more fatal, if not more prevalent, by foul air. Any sanitarian might designate in a city what wards, blocks, courts, alleys, and houses, will always afford the largest number of deaths from scarlet fever, measles, and cholera infantum from year to year, and from diphtheria, cerebro-spinal fever, typhus or cholera Asiatica, when either of these prevails.

The great importance of impurity of the atmosphere as a factor in the mortality of infants in large cities, has been fully recognized in times past. There seems to be some ground for fear that it may be, at the present time, too little borne in mind, under the almost overshadowing attention given to another factor, itself truly of great consequence — *bad feeding* of children.

Errors in infantile *diet* may be considered briefly, as they occur: 1st, when the child is suckled, in part or altogether, by the mother or a substitute; 2d, when it is fed entirely by hand or with the bottle.

Feeble mothers cannot often, although they do sometimes, rear healthy children. Women obliged to work hard, and sometimes to leave their infants for many hours together, neglect them, almost or quite unavoidably, to their great detriment. Weaning occurs thus prematurely, and privation of natural food invites early death. At the opposite scale of society, in some countries, most of all in France, but to a small extent only in America, indolence and luxury amongst the rich induce mothers to thwart the instinct of maternity by placing their offspring under the care of hireling nurses, often away from their homes. The large mortality of children so treated has, for a number of years past, attracted the serious attention of French physicians and sanitary observers. Bertillon reckons that one half of the nurse-children of Paris perish during their first year. The same sort of evil is intensified fearfully in foundling hospitals, whose death-rate has always been immense. During the first year of the New York City Foundling Hospital (1869–70), fifty-five per cent. of all admitted to it died. This was comparatively moderate. In the Dublin Foundling Hospital, during the last century, according to Sir James Simpson, of 12,000 infants received only 135 lived. An improvement upon this was certainly witnessed, when, from 1795 to 1826, of 52,000 admitted only 41,000, about four fifths, died.

It has been sagaciously remarked by Dr. W. T. Gairdner,[1] that "the safe and wholesome feeding of the infants of a large community, depends absolutely upon preserving for its proper use the whole stock of available sustenance provided by nature in connection with the whole number of births in that population." Whenever, therefore, either rich votaries of fashion, or poor victims of necessity, abstract from the supply of natural infantile food in a community a considerable amount, deterioration of health and abridgment of life in children must follow.

On the various modes in which vast harm is done, chiefly through igno-

[1] *Glasgow Herald*, March, 1874.

rance in the feeding of infants brought up by hand, it would be out of place for me here to enlarge. Much has been written thereupon by a number of medical men within a few years. Nothing better has come under my notice, on this part of our subject, than the "Rules" issued about two years ago by the Obstetrical Society of Philadelphia, the wide dissemination of which amongst the poor of our large cities would, I believe, be of great service. Our *confrères* must pardon my honest opinion, that preference may be maintained for these rules over a series, similar in many respects, published somewhat earlier in New York. Glancing, merely, now at this topic, I may say that the *worst* errors often committed are these: 1st, giving infants *stale* milk; 2d, *watering* the milk overmuch; 3d, substituting *farinaceous* or other food *incompetent* to supply tissue-waste and maintain life. As to the first of these points, it ought to be understood that, in hot weather, milk becomes practically and effectually stale before it begins to sour, and that, to delicate infants, every hour counts, in the danger added by the keeping of their food.

Watering milk has become a by-word, and not without reason. Professor Chandler reported officially, a few years ago, that, on the average, in New York one quart of water is added to every four quarts of milk. Prof. J. F. Babcock, of Boston, found that ten out of twelve samples of milk served in that city were adulterated with water, from ten to twenty-five per cent. I believe it to be better in this city, but I cannot say how much. Moreover, I consider that medical opinion has undergone some improvement, in late years, in enjoining less considerable *intentional* additions of water to the milk given to young infants.

The unsuitableness of *starch foods* for infants under five or six months of age, and their insufficiency *alone* at *any* period, are matters now well understood, at least in the medical profession. In a word, *no* food for infants, be it Liebig's or that of any one else, can substitute good fresh milk, if not from the mother's breast, then, next best, that of a healthy wet-nurse; failing these, milk from the cow, the ass, the ewe, or the goat, either of which will do, under favorable circumstances, with proper care, though always with a lowered probability of life.

Time may not now be afforded me to do more than mention the heads under which we might consider the third portion of our present subject; namely, the nature of the diseases which are especially destructive to young children. These are, in the great cities of the Northern United States, cholera infantum; small-pox, when vaccination has been neglected; cerebro-nervous disorders, with convulsions; pulmonary inflammation; croup; diphtheria, when the latter is epidemic; cerebro-spinal meningitis, when it is locally prevalent, and scrofulous marasmus. Some cities in the Old World receive very large additions to these mortuary causes, from Rickets, tetanus neonatorum, and other affections which, although they occur here, are with us of less comparative frequency, and (for that reason only) of less practical importance.

Now, what can be done to lessen this truly frightful array of influences hostile to infantile life and health? In a few words there may be indicated here some principles only, without details.

To meet *ante-natal* deleterious causes, connected with parentage, we must look chiefly to *popular education*, *moral reform*, and *sanitary police*. Under the last named, should be included inspection and sanitary improvement of dwellings and localities in cities. Against *post-natal* causes of infantile mortality, similar measures will be of great importance. Means should be taken to diffuse information amongst all classes, and especially the poor, concerning *food* (most of all the need of freshness and purity in that which is given to children), *cleanliness*, and *ventilation*. Holly-tree inns and Temperance Coffee-houses ought to be established, to give cheer and comfort without inebriation, in every quarter of every city. Children's excursions in hot weather should be, as they now are, made the generous duty of the richer, and the life-giving enjoyment of the poorer class.

Yet more than all this is needed. Dr. J. M. Toner and myself have incurred, perhaps, the charge of being impracticable, in proposing that *summer camps*, for mothers with young infants, during hot weather, should be provided outside of every large city. For the first year, my estimate is that this might cost from $75,000 to $100,000 for Philadelphia; less in succeeding years. *There is no difficulty about it except that of procuring the money*. Is it worth while? The answer to this depends upon our estimate of the value of human life. Not only the direct rescue of a considerable number of infants (probably 500 per annum on the average in this city) from death, might thus be accomplished. Such camps would also be *training-schools in healthy living*, to all who occupied them; the effects of which would last long afterwards. Moreover, by the removal of a part of their population, the worst quarters of the cities so relieved might be open to inspection, and effectual, permanent, compulsory sanitation. So, the tenement-houses of New York, in which[1] half the children of that city are born, and of whom half, probably, die in their first year; and the tenement-houses of Boston, and the Alaska Street shanties and cellars and other such nuisances of Philadelphia, might be, and ought to be abolished; and in their place might grow up *homes* for working-men, in which children might not only be born but *live;* as George Peabody, and Miss Burdett Coutts, in England, and the Boston Coöperative Building Company in this country, have shown can be done.

Is this *utopian?* Under the progress of our Christian civilization, the utopia of one decade may become the realized ideal of the next. Only prove that an evil is *real*, *great*, and *removable*, and philanthrophy and patriotism ought to combine to effect its rapid and entire extinction.

In regard to public health as well as to public morality, *ought* and *must* should be convertible terms. One function of bodies like the American Public Health Association is, to promulgate and make practical such truths. Not piles of brick, granite, or marble, chiefly constitute or manifest the wealth of cities; but rather the distribution throughout their precincts of the best common gifts of Providence, — pure air, unobstructed sunlight, wholesome food, untainted water, popular education, and healthy occupation for all.

[1] Dr. A. N. Bell, on the "Waste of Life." *Trans. of Am. Med. Association for* 1874.

REPORT ON THE INFLUENCE OF HEREDITARY DEFECTS ON HEALTH, WITH SUGGESTIONS FOR THEIR PREVENTION AND ERADICATION.

By J. R. BLACK, M. D.,

Professor of Hygiene in the Starling Medical College, Columbus, Ohio.

SECTION FIRST, READ AT MEETING IN PHILADELPHIA, IN 1874; SECTION SECOND, READ AT MEETING IN BALTIMORE, NOVEMBER 12, 1875.

SECTION FIRST.

The glory of a nation is in its strength, not of physical prowess merely, but of that mental depth, breadth, and energy which subordinates the lower instincts and the exterior forces to the will. These two kinds of energy are most intimately correlated, each depending for its highest manifestations upon perfection of organization. The doctrine may now be said to be established, at least among all the deepest and most advanced thinkers, that organization and function are one; or, that there is in the body no independent spirit or principle apart from that inherent to the various forms of organized matter. The inter-dependence and the inter-action of organic structures, and their dependence upon exterior conditions, support rather than invalidate the doctrine. The full significance of these views upon the great questions of human welfare and human development does not seem to be generally realized. So far as mere terrestrial results are concerned, they mean that the biologist must supersede the theologian, that improvement, whether of body or of brain, must be through the culture of organic structure, in all its manifold relations.

In contending against these deeply rooted errors, prejudices, and unbeliefs, sanitarians have the odds largely against them; and of these errors, none are deeper than the prevailing notions upon the subject of inborn defects. While there is a general assent in a few kinds to ancestral responsibility for innate imperfections, the prevailing doctrine is that in the first stage of the evolution of a new being there is, at least, something akin to creative interposition involved. In popular language, a new soul or spirit is made; it is in no sense an outcome of organic growth. Hence, by implication, there is here supposed to be a hiatus in human responsibility in reference to the formation and qualities which perspective offspring may display. This conclusion is borne out by the fact, that the great majority of fathers and mothers regard the birth and care of a sickly, or dying, or deformed, or imbecile child as an affliction sent, — not as a token and punishment for the violation of natural law, — but, if anything, that the spiritual condition of those most nearly interested may be improved.

Our ability always to trace the causative chain may be sometimes at fault, yet this does not invalidate the overwhelming amount of evidence which might be brought forward to prove that the constitutional perfections or imperfections of an infant are strictly and wholly derived from the progenitors. The presentation of the facts relating to this point would require a volume, and I will only call your attention to two or three of the more comprehensive.

Life-insurance companies, in calculating the chances of a risk, pay more attention to family history than to any other point, — a bad one being sufficient to turn the scale against the very best health which the applicant may present. The slighter forms of inherent defects receive universal recognition, as in hair prematurely gray, or in baldness, by the familiar remark that "father or mother were so at my age." But if there is so much persistence in the transmission of the forms and qualities of life, what hope is there of the eradication of hereditary defects? The hope lies in this very important difference, that while all normal characteristics have a high degree of persistence, abnormal ones have a very low degree. The evolution of the normal or physiological is a very gradual process, and so also are any of its modifications; but the production of abnormal or morbid characteristics is a comparatively rapid process, and so also is that of eradication. This averment concerning the production of abnormal states of the body may be said to be beyond all question, but the same cannot be said of eradication. This in part arises from the accidental absence of as much evidence of one as of the other. Enlightened and systematic attempts to eradicate constitutional defects have rarely, if ever, been made. In other words, the consequences of a systematic disregard of the laws of health are very well known, from the fact that, either through omission or commission, the disregard is almost universal; while, on the other hand, the consequences of an intelligent compliance with hygienic laws are almost unknown, from the fact that very few have an intelligent conception of what such laws are, and yet fewer yield an unvarying obedience to them. Nevertheless, that the possibilities are ample in this direction, every observant physician has the clearest evidence, a summary of which will more appropriately appear in the sequel.

A hereditary defect may imply a disease directly transmitted, as in syphilis or scrofula; or a deformity, as in hare-lip, or simply a tendency to some disease, as in insanity and tuberculosis. Oftentimes the last kind of defect seems as if it consisted only in an organic weakness or tendency to disorder from very slight exciting causes. Doubtless there is a histological relation of structure to vigor and weakness, but precisely of what this consists, apart from the relation of size to strength, has not been determined.

The way in which ordinary forms of hereditary defects originate is not difficult to comprehend. In fact, it is often practically demonstrated to every competent observer, especially in the larger cities. Take, in illustration, the hygienic change which is often involved in the substitution of city for country life. As a rule, the residents of a salubrious country district are freer from taints of blood and defects of organization, than those of a

city; their hygienic environment is good, and they have rarely the opportunity or the temptation to fall into frequent and gross violations of sanitary laws. Their excellent health, superior organizations, and longevity are, however, far more the outcome of their surroundings than of intelligent design. They could not well help being other than they are in these particulars. A young countryman and wife, in such a physiological condition, remove to a densely inhabited city where sanitary surroundings are unfavorable, and plunge at once, as often they do, into all the excesses and dissipations which their circumstances permit. The result ere long will be a more or less profound impairment of the vital tone of some part of the body or of the whole. That this impairment becomes a transmissible quality has been well known ever since the time of Moses, who declared that the "sins of the fathers are visited upon the children to the third and fourth generations." Their children, therefore, start in life on a lower plane of vital force than the parents, and a less favorable hygienic environment throughout childhood can only tend to aggravate and confirm it. These unhygienic circumstances, with defective out-door exercise, stimulating drinks, irregular hours, premature and excessive indulgence of passions, etc., etc., unite to reduce the grade of constitutional stamina yet lower, which will be duly transmitted to succeeding generations, until almost every vestige of the pure and richly endowed physique of the progenitors to whom I have referred is obliterated. This is no fancy sketch, but a process and a result which every physician of extensive experience must have witnessed again and again. All, however, under these changed circumstances, do not infringe the same laws of health, nor to the same extent. With insufficient exercise and a long continued and large indulgence in refined, concentrated, and complex food, the digestive organs will be the first of the vital harmonies to fail, and if the same habits are continued for a generation or two, — a thing very likely to happen, — an inbred weakness of these organs will become an inheritance of the offspring. If, on the other hand, the infringement of vital law consists in great mental strain, or in the continued and excessive use of stimulants and narcotics, or both, some form of nervous impairment will ensue, which, if prolonged, may end in insanity, or in a predisposition to invasions of some of the terrible forms of nervous disorder, by which civilized people are so commonly afflicted. Or, suppose that the syphilitic taint becomes a constitutional blight of blood and tissues; this, with insufficient out-door exercise, and the long-continued breathing of impure house air, will be very sure to give rise to pulmonary consumption. Thus the violators of the laws of health may, and do go on in an almost infinite diversity of ways and degrees, originating and complicating taints of blood and defects in organic form and force, and transmitting them from generation to generation, until the wonder is, not that mankind are the most sickly of beings, but that life should exhibit so much persistent tenacity and uniformity amid conditions so unfavorable.

This outline sketch of the origin of constitutional defects fully comports with the latest deductions of biology. The conditions which produce varia-

tions physiological and morbid, are no longer held, by any one of a broad culture, to be either supernatural or accidental; and the fact, that these variations are transmissible from one generative link to another, is that on which the conception of the comparative continuity of species rests, as well as the basis of the most profound of all modern doctrines, — that of evolution.

Elsewhere, in an attempt to codify the laws of health, I found that they might be embraced under ten heads, or into a sanitary decalogue. Those who have given these laws any attention, are fully aware that there are few persons who do not violate them, in one way or another, almost every day of their lives. Nor is obedience at all impracticable; it is merely a question of knowledge and of will. But knowledge of this kind, to be available, must not be confined to a few scientists; they cannot recreate their fellow beings, and infuse into them health, vigor, and good constitutions. Each one must know and act for himself or herself, else a great deal of sanitary lore will be made practically obsolete. This, in great part, is its condition to-day, and in the past has been one of the immediate causes of so many imperfect and wrecked constitutions. As it is extremely uncommon to find any one who has lived up to the sanitary decalogue, — and then only through the accident of circumstances, — so, it is extremely uncommon to find any one who has not some inherited or acquired weakness of constitution. Even with the most careful usage, the inherited frailty of some organ is made evident by wearing out much sooner than the others. This is death beginning in the lungs, stomach, liver, heart, or brain, as the case may be. Excepting the one organ, all the others have sufficient vigor to last for many remaining years, and hence the agony of dying inch by inch, and not as a whole. The very few who go down unto death even as they rose into life, by a gradual, harmonious, and uniform decadence, no one part failing faster than another, proves how few there are who have not some inherited or acquired degeneracy.

And of late, paradoxical as it may seem, the achievements of science have actually tended in this way to produce an increase in the number of degenerate men and women. A great portion of the efforts of specialists in the medical profession is devoted, with untiring zeal, to the preservation of all our weak and defective children — the cripples of the race — and to nurse them up into manhood and womanhood, when they in turn become the procreators and multipliers of their kind. Before art, guided by science, did so much to bring our puny young through the perils of childhood, the rule was that only the fittest or strongest survived. Now, that the selective operation of this beneficent law is in part modified by the increased resources of medical science, it becomes sanitarians — as exponents of the best means of preserving and developing the highest type of manhood — to go to the root of the evil and counteract this new source of danger, by pointing out the way by which this sedulous preservation of defective blood shall not operate in an increasing ratio to the production of a race yet more prevailingly puny, sickly, deformed, and short-lived.

Who can conceive the pain, the misery and distress, to which any one of

those unfortunates is subject who has inherited a serious organic frailty, or a pernicious taint in blood. The dread of possessing a constitution planted on the verge of certain disease, the days, the nights, the years of suffering which it involves, or the torment of ever-present consciousness of some inherent defect of body or limb; in manhood, the fear of disease and untimely death; in the paternal relation, the worrying care and intense solici tude which feeble, sickly offspring cause, — all this, to say nothing of lost time and expense for medical aid, goes to make up a record that is often repeated in our midst.

The first and great requisite to prevent all this is knowledge, — knowledge of what constitutes the true conditions of vigor, symmetry, and health. Not a few persons are of the opinion that these conditions are very well known to the popular mind. Observations have led me to a different conclusion. Many entertain vague ideas on the subject, most frequently those persons who have more vanity and fancies on the subject than scientific culture and a large experience in the causes of the fluctuations between health and disease; a few thoroughly understand the purport of one or more of the conditions of health, and perhaps attach an undue importance to them, the while, ignoring or neglecting other conditions quite as essential to health. Knowledge on this subject to be useful, needs to be personal and thorough, no mere elementary smattering, to which the mind may passively assent, but such a deep and thorough familiarity with the subject as will enforce the conviction that the alternatives of pleasure or pain, health or sickness, long lives or short ones, are, except from chances infinitesimally small, wholly in our power.

Precisely that which prevents sickness will also prevent the stamping of an inherent defect upon the organization. It is either protracted impairment, or oft-repeated derangement that leaves the traces of an imperfection. And in the acquisition of such imperfections and some degree of constitutional instability, all hereditary defects originate. The injudicious crossing of defective blood, also undoubtedly serves to intensify these imperfections; especially when the constitutional defects of the father and mother are of the same, or of an allied kind. The prevention of hereditary defects lies, of course, with the procreators, supposing them to be free, or nearly free from physical imperfections. Their term of responsibility, however, may be said to extend through the childhood of their offspring, as it lies with the parents mainly to determine whether this period of life, so fraught with future good or evil, shall be ruled by, and subjected to conditions congenial or inimical to a healthy, robust life. The sphere of prevention is naturally arranged into two parts: that which pertains to the individual, and that which pertains to the community; the one being of a private, the other of a public nature. In all densely populated regions the one is more or less nugatory without the other; it is only by their conjoint action that all the rules of prevention can be effectually carried out. If the members of one family live according to the requirements of the sanitary decalogue, and their neighbors do not, the former become involuntary partakers of the ills by which they are surrounded. The free movement of the

atmosphere may be hindered around their dwelling — the air wafted into their chambers as food for the lungs may be contaminated by collections of organic filth, by cesspools, by the gases arising from chemical transformations, by sewer exhalations; their drinking water may be insidiously polluted, their food skilfully adulterated, their school-rooms and churches made mere boxes of corrupted air; the requirements of the instructors of their children highly injurious, if not cruel; and above all, they may be frequently exposed to the germs of infectious diseases which are nearly always lurking in the insalubrious dens and slums of a city and which acquire a peculiar virulence among reckless transgressors. Unless the law renders aid and protection against such public sources of danger to health and life, it is obvious that the efforts of individuals to prevent or eradicate hereditary defects are, in part, impracticable, and that the liberty to be always free from disease cannot be said to exist.

The ultimate object of law is to protect life, liberty, and property, and to promote the highest good of the greatest number. Its influence in these respects is educational, mandatory, and shielding. Sometimes it is wise for it to be in advance of public sentiment, at other times to follow it. When, from the superior insight of the best intellects a new way is discerned to render life more secure, as well as to promote the general good, it would be folly to await the tardy elevation of the popular mind to the plane of those highest intellects. It would here seem that legislatures should not hesitate to enact appropriate laws; and if public sentiment should not prove equal to their enforcement, at least the influence would be educational and salutary. This is precisely the basis and true philosophy for a sanitary code. The popular mind may not discern the necessity or feasibility of such a code, yet if the most trained intellects do both, and the objects besides be plainly shown to be to protect health and life, and to promote the general good, it is difficult to see why there should be any hesitancy in the matter. Its great cardinal principle is one that eminently pertains to the function of law, namely, to prohibit one person from needlessly and recklessly endangering the health and life of another. In carrying out this object, while it would limit the extent to which reckless or ignorant carelessness may be carried, it would enlarge the area of freedom for others by rendering it within their power to escape the ravages of disease, and the fate of an untimely death.

There is another or a national aspect of this question which, in this connection, deserves consideration. In a nation as in a family there is a certain mutuality of welfare. If one or more of either are frequently disabled by sickness, or if defective in mind or in body, the others have an additional source of care, labor, and anxiety imposed upon them. All civilized nations feel it incumbent to support the helpless and the needy in sickness, as well as to provide for those deprived of intellect, or of the more important of the special senses. To render this aid more effective and economical it is systematized by erecting thousands of poor-houses, retreats, vast hospitals, asylums for the deaf, the blind, the idiotic, and the insane. Palaces by the hundred, dollars by the million, to preserve our blighted specimens of

humanity, but not one of either to diminish the hecatombs of needless victims!

In time of war, twenty-five per cent. of the male population between the ages of twenty-one and forty-five are exempted from military duty on account of physical disabilities, mainly the result of inherited defects; and from twenty to thirty per cent. of those drawn into the field, are, on account of imperfect constitutions, unable to withstand its hardships, and are either nearly always sick or become permanently disabled. A government makes an exceedingly bad contract in employing such frail servants; for not only is little or no service rendered for the compensation received, but there is a heavy outlay involved in caring for them, and in case of death, or of more or less disability, in the payment of pensions for life to themselves or their heirs. Yet the system of selection cannot be much improved, as inherent constitutional defects are of all others the most frequently kept out of sight by the prudent habits of private life, and made alarmingly prominent by subjection to the hardships of the public service. In the light of these facts it is almost needless to say that a government in order to protect its own interests, and to foster the national strength, should have the physical welfare of its subjects deeply at heart. Whenever this is publicly endangered, or injured by the acts of the careless, the ignorant, or the reckless, and in a way in which individuals or corporations are helpless, it is plainly within the sphere of state or national laws to intervene. This principle may be illustrated by a single example. With the modern comforts of travelling along our highways comes the possibility that any one sick of an infectious disease may, so far as the law is concerned, scatter the seeds of disease along a densely populated route of hundreds of miles, or even from one State to another. I knew of a lady sick of small-pox, who, closely veiled, travelled in the sleeping compartment of a Pullman car for hundreds of miles, against which outrage individual protests were powerless.

It is also certainly within the sphere of a General Government to enlighten its subjects on matters of great importance to their welfare, whenever individuals or corporations are unable or incompetent. I will illustrate this by a single phrase of the sanitary question. In every section of the Union are local conditions which remarkably influence the physical development, and the sick and death rates of the inhabitants. Precisely what these are can never be definitely known, nor be made perfectly plain to the popular mind until the General Government collects, in a systematic manner, all the statistical evidence which has a bearing upon the subject. But if the local and general governments continue to refuse all aid and encouragement to physical improvement, if they will persist in the monstrous incongruity of making elaborate provision for the care of tens of thousands of human wrecks, and do nothing, or next to nothing *to save*, when so much is properly within their power, why we can only know that for years to come poor humanity will stumble on in ignorant thoughtlessness through the same old sloughs of pain, disease, deformity, and unnatural forms of dying. True, the efforts of voluntary Health Associations may accomplish something, but nothing systematic, nothing that will be immediately felt throughout the

length and breadth of the land. A few here or there may be enlightened and strive to prevent, or obliterate hereditary defects, but their success will be more than doubtful so long as they are not protected from the death-dealing conditions by which the ignorant and reckless are continually surrounding them.

Upon the supposition that laws give every person adequate protection against public conditions inimical to health, what should each individual do in order to prevent hereditary defects? The subject is too extensive to be here handled in detail, and I cannot better present general principles in a small compass than by reciting certain points of duty and practice which every person should observe: —

To avoid the breathing of impure air, from whatever source, and especially not to rebreathe the breathed air of a house, always bearing in mind that the lungs require their food pure, not two or three times a day, but fourteen times every minute;

Avoidance of confinement in dark or damp rooms, or to any sedentary occupation, more especially during the period of growth;

To clothe the body thinly one hour and thickly the next, leaving one part wholly unprotected, and another covered with a double or triple layer of clothing;

Compressing or hindering any part in its natural movements;

Tempting the appetite to excesses by rich and concentrated foods, by a great variety at a meal, or by dishes rendered highly complex through culinary art;

Drinking or otherwise using largely of stimulants and narcotics;

The use of the sexual function for purposes other than reproduction;

The adoption of an occupation which constrains the action of the body or subjects it to irritating or poisonous substances;

Lack of personal cleanliness;

A residence in a climate for which the constitution of the body is not adapted;

Excessive mental strain, corroding care, or insufficient rest and sleep;

Marriage between persons defective, or nearly related by blood.

A very remarkable quality of the vital force is that by which it is enabled with much persistence and fertility to resist the unfavorable habits and conditions to which it may be subjected. When, by a serious and protracted illness, the flesh and strength of the body have been reduced to a point at which death appears imminent, there is often seen a quick restoration, and ultimately an entire renewal of the flesh and strength. Just how this power is able to renew itself, to take on one increment of strength after another till it rises to the old brim of fullness and no more, is a mystery that "passeth all understanding." By some it has been termed recuperative energy, by others the *vis medicatrix naturæ.* It is more like an elastic force than any to which I can compare it. Press it down and it will rise again; render this pressure very severe and protracted and the elasticity will be impaired; but destroy organization and it is lost forever. On this elastic quality of life whereby it tends to rise to its normal limits of volume and power, must

all hope rest of our ability to effect an ultimate eradication of hereditary defects. By removing the pressure to rebounding power; or in other words, by ceasing to cause the enginery of this force to work in antagonism to law, and by placing it amid the most congenial influences especially from birth to adolescence, there is every reason to believe that recuperative energy will ultimately remove the inherent weakness of one organ quite as certainly as it removes the weakness of the entire body, arising from an attack of sickness. The process is no doubt a great deal slower in the one case than in the other, but it is essentially the same and none the less sure. In this respect restoration is correlated to production. As it usually requires the successive sins of a father and son to break the strength of a good constitution so that their sins shall be visited upon the children to the third and fourth generations, so does it usually require the successive righteousness of a father and son suffering from the sins of their ancestors to restore the long-lost health and strength of their blood.

But there are some *innate* defects so extreme and so profound that they are ineradicable, and usually end in a violent death, or in extinction through infertility. The number of those which prove ultimately fatal is largely increased by the neglect of proper measures of eradication during the period of childhood. This time of life for such a purpose is most invaluable; yet it is very lightly esteemed, judging by the fact that about the same routine of objective and subjective influences are carried out in the case of all children, wholly irrespective of any constitutional idiosyncrasy.

In systematic attempts to get rid of a family taint in the blood, or of some organic frailty, — in addition to a careful avoidance of the causes which produced it, there are two points of special importance which require to be always borne in mind: first, in contracting marriage, to secure a partner as physically perfect as possible, and especially free from the same taint or frailty; second, to carry out, during the whole period of growth, the strictest principles of hygiene, and to enforce all the conditions most favorable to the most perfect development of the part organically weak. The possibilities of the physical system for good or for evil are during this period very great. Strength and perfection in the structure of every tissue are modifiable to an unusual degree. The removal of a specific taint, or of a specific organic weakness, may require a uniform subjection to a special class of influences. It is almost needless to say, that our social and educational systems do nothing of the kind. The scrofulous boy, the boy predisposed to disease of the lungs, of the stomach, or of the brain, eats the same kind of food, takes the same exercise, breathes the same quality of air, goes through precisely the same school confinement, as the stoutest of his associates. On this subject there is not even that rational regard of cause and effect which there is in the management of a machine. In a machine, the weak part is carefully watched, saved, and, if possible, strengthened; in the human body, a weak part is regarded with indifference so long as there are no actual signs of disease. If the first indications of this condition receive prompt attention, parents think they have done all that can be done for such a case. It is a most unfortunate mistake, or rather a most unfortunate

state of information on a topic of so much importance. It is of course impossible within the limits of a brief paper to lay down all the rules applicable for the removal of the various kinds of weakness which children inherit, but I may properly outline two or three in order to illustrate this part of my subject.

A child whose immediate progenitors have displayed a great deal of digestive derangement should be specially guarded on two points, — diet and exercise. From infancy up, a rigorous exclusion of all foods rendered artificially complex, refined, or concentrated, — or, in short, no cuisine delicacies whatever, only nature's, and these in abundance and properly cooked; out-door play, plenty of it, and very little confinement in the school-room.

An individual predisposed to lung disease should never be allowed to stay in a room, day or night, through which air does not freely flow; an active out-door life, in a region high and dry, and the air pure, from morning till evening, giving due encouragement to the more active sports, such as running, skating, rowing, or horseback riding; adequate protection to the skin against dampness and cold, a liberal sustaining diet, but no cuisine delicacies. For one predisposed to brain disease, a rigorous abstinence from all, even the mildest stimulants and narcotics, regular and sufficient hours of sleep, a free out-door life, no tasking of the brain, an adequate supply of nerve-food, such as may be found in unbolted flour, fish, etc. For all these there should not be, during the period of growth, any continuous daily labor exacted. A striking illustration of the regard of this rule for the good of domestic animals, and disregard of it to the detriment of human beings, is afforded in the rules practiced by our farmers. In raising their stock, very little labor is exacted of a young ox or of a colt, on account of the well-grounded fear that it may stunt or injure the perfection and symmetry of its development. They manifest no such fear in the care of their children. The energy which should be devoted to growth and perfection of structure is spent in toil; they strive to make their children productive machines long before organic construction is completed. Then the excessive mental toil exacted in the school-room is, if anything, more disastrous, especially to those having the slightest predisposition to any nervous disorder. It implies not only an undue suspension of that varied frolicking out-door motion so essential to physical perfection, but of undue brain-toil, that abstracts instead of adds to mental power. For the young all kinds of exercise are needful and beneficial; but carried to fatigue, especially in a late and slow-developing organ like the brain, it draws out in performance what should be spent in ripening structure or for promoting the conditions for the best and highest development.

A great deal more might be adduced to show that the prevailing one-sidedness of our social and educational modes of dealing with the young tends to foster — nay, to originate — almost every variety of hereditary defect; and until a radical reform in this is effected, until man exonerates God and Nature from the consequences of his own ignorance and folly, and rightly interprets the significance of the admonitory punishments which cry

aloud and spare not, in the form of the many pains and diseases to which he is now so unhappily subject, — it is vain to hope that his physical condition will ever be materially improved.

ERADICATION OF HEREDITARY DEFECTS.

SECTION SECOND.

THAT like begets like is among the most familiar of truths. It applies to anatomical, to physiological, as well as to certain kinds of pathological peculiarities. Any of these in the offspring are not, however, exact copies of those in either parent, nor even of an evenly-balanced union of the two; the minor characteristics of body and mind which constitute individualization being unstable to the blood, their variations may be said to be infinite. There is one class of characteristics of a more stable nature, — such as peculiarly appertain to a race, or even to a nation. Here a certain type is maintained with a high degree of uniformity. Place in a single group, say, a hundred parents and their children, and it would be impossible for the most practical observer to detect, even in greater part, those of near consanguinity by any physical resemblances; but if, on the other hand, an indefinite number of Indians, Europeans, and Africans, or even of Celts and Teutons, were presented to view, no one could fail in detecting through their physical characteristics the lineage or blood of each in the group. The qualities of race, and even of nationalities, are more stable and are reproduced with a much higher degree of fidelity than those that pertain to the individuals of the same blood. This receives verification in the crossing of races or breeds, the blending in the progeny of such typical peculiarities being much more perfect and uniform than of the minor differences of two of the same blood.

If we attempt to analyze the typical physical peculiarities of a race or species, the persistence of a certain aggregate of outlines and colors will be found to be their most striking quality. Among all the numbers of a species there are minor differences; but, as has been said, they are not persistent, — that is, they follow no uniform type, — no two can be said to be exactly alike. Every individual evinces his own peculiar variation from any fixed standard, but this never has an exact nor a midway reproduction in the offspring. It is transitory and modifiable in the descendants to a remarkable degree. No matter how numerous the offspring of a man and woman may be, no two of their children are exactly alike, — nay, they are even often extraordinarily unlike. Why this great variability of individuals and the great invariability in the typical peculiarities of the race to which they belong? In the present state of knowledge the question is not susceptible of a very satisfactory answer. But the following seems to make the nearest approach to a solution of the problem: An indefinite aggregate of human beings, subject in common for many generations to a peculiar environment, and being subject also in common for a like time to

certain peculiar modes and habits of life, become gradually and more or less uniformly moulded into a similar type through the similitude of the typical influences which gradually cause the body to assume what are known as national characteristics, as in the Jew and Gentile, the Celt and the Teuton; and if such influences are continued upon the same blood for thousands of years, and are at the same time in their nature strikingly different from those appertaining to other peoples, the result would be a typical differentiation sufficient to constitute a race. If the similarity of conditions is sweeping and long continued on the same class of men and women as it once was, when the range even for a nomadic people was comparatively limited, the effects are not only quite uniform, but the long continuance of the cause is apparently what insures their persistence. The correctness of this position is attested by some striking changes that have occurred in the Jewish race, even during the comparatively short period of the historic era. It is well known that this people religiously aim to preserve the purity of their blood, and that they have long been scattered over every quarter of the globe. Those of them who have dwelt in tropical regions for many centuries have become typically assimilated in a very striking degree to the natives of the country, so much so that it is difficult to realize that they are of pure Jewish blood.

That the comparative persistence of typical differentiations arises from the long-continued influence of a peculiar environment and of the long-continued influence of certain prevailing social conditions, is further borne out by a vast collection of facts which have been arrayed in support of the doctrine of evolution. It even receives support from the most recent advances in the domain of psychology. In a late article by Professor Le Conte in the "Popular Science Monthly" is drawn with remarkable acuteness the distinction between the evolution of instinct and of intelligence. Instinct he defines to be accumulated experience, or knowledge of many generations fixed permanently and petrified in brain structure. This experience has always operated in a narrow channel; it has worked in the same lines for many generations until it has, so to speak, worked out grooves in their brain structure so deep that they are transmitted unimpaired from one generation to another. On the other hand, in a high intelligence, the mental acts are so numerous and varied that they leave but slight traces of their operation on brain structure; they are therefore readily effaced, and do not become so petrified as to be transmitted in an unimpaired form from generation to generation. In the former it is the never-ending repetition of the same thing, of the same cause that produces the uniformity and persistence of the effect; while in the latter it is the wide diversity of mental acts and the rareness of any exact repetition that accounts for the fact that there are none of them so deeply fixed or petrified in the brain as to become transmitted and so become persistent characteristics. The same course of reasoning applies to the persistence of the typical peculiarity of a race. The causes have been in operation so long and with such uniformity that the effects have become petrified in structure, and, like instinct, they are transmitted from generation to generation with remarkable fidelity.

Having thus endeavored to account for the persistence of a certain type in a race, let us briefly examine into the causes of the variability among the individual members of the same stock. This is confessedly difficult ground, and requires the utmost circumspection in the endeavor to thread our way. Yet we may rest assured that the cause or causes of individual peculiarities are not arbitrary or fortuitous, or that, in other words, there are laws governing the evolution of such peculiarities, though they may be so subtle as forever to elude our ken, or so complex as not to admit of successful analysis. Darwin's theory of pangenesis is a provisional attempt in this direction; and while its truth or falsity has yet to be demonstrated, it nevertheless is of important service in the attempt to give shape and system to our ideas upon the subject. The fact ought not, however, to be overlooked, that this notorious theory is a product of what Mr. Tyndall terms the *scientific use of the imagination*, rather than of an attempt to show what antecedents stand in a uniform relation to the consequents under consideration. Let us briefly examine this difficult subject. Grant that each organ of this body has its own autonomy, reproducing only the atoms or germ-matter of its kind, and that the development and aggregation of these are governed by their special affinities, — all this throws no real light upon the causes which impress individuality upon the embryo. It is possible, nay, highly probable, that this germ-matter may be the instrumentality through which the moulding forces are performed; but what are the conditions which govern, modify, advance, or retard the development of this or that kind of specific germ-matter? To apply the doctrine to a special organ; why is it that the primordial germ-matter of the cerebral mass develops much more perfectly in one child than in another of the same parentage? If it be answered favoring conditions, we are as much in the dark as ever, unless the favoring conditions are eliminated from the unfavorable, and brought before the mind, at least in specific outline.

It is now generally admitted that we can never understand why certain agents or conditions influence for good or for ill the forms and forces of organic life. We can only know that they do, and a full comprehension of their relationship should be our sole aim; as it is through this method only that we can advance to the boundaries of the knowable. In applying this method to the solution of the problem of idiosyncrasies, the only rational ground of approach is over that which we have attempted to show pertains to the development of the types of the various races. The latter are comparatively uniform and persistent, apparently from the fact that their causes have been so, that is, all the conditions appertaining to an environment, such as the degree and changes of heat, of moisture, of the seasons, of electric disturbances, of altitude, etc., together with those arising from social condition, as the nature of the food and drink, clothing, the prevailing modes of training, thinking, and acting, — or, in short, from all the habits and customs. All these conjoined in certain peculiar and prevailing ways, and acting in a more or less uniform manner upon a large number of people for many generations, result in the evolution of certain types having a high degree of uniformity and of persistence. Now as each race or even a nation-

ality is subject in common to a prevailing and peculiar environment, and to certain prevailing customs and modes of life, so is each member of that race or nation subject to a slightly peculiar environment, — that which he or she creates; and much more largely to individual variations in all the customs and modes of life. For example, there is an aggregate of conditions which tend to the formation of a certain type of body or of character called national; so is there an aggregate of conditions peculiar to personal life which tend to the formation and modification of individual characteristics. All the conditions to which each man is subject vary from day to day and even from hour to hour. He may create for himself some slight local modification of his environment; he may vary his food, drink, exercise, exposure, modes of thinking and acting day by day; in short, all the conditions known to have an influence upon organic forms and forces may and do vary more or less from day to day and from year to year in the life of each individual. It is to be supposed, not that these transitory and minor influences are of no effect, but that they differ from the major only in degree or in the lightness and evanescence of their impress. Yet there are some influences, strictly limitable to the individual, of a more permanent character. In the quality of the environing air, in the food, in the drink, in the play of thought and of the emotions, one person may all through life differ very greatly from another. We have then two classes of conditions — one of an evanescent, the other of a more permanent nature — peculiar to each person, to account for the genesis of individual modifications. In the application of this doctrine to the phenomena of heredity, we have only to realize that there are minor and ever-varying causes of slight organic modification; that these are continually operating upon the molecular structure and subtile force of the body; the which, being granted, it necessarily follows that these imperceptible and often transient modifications may have expression in the ovule of the female and spermatozoa of the male; and that the modifications thus minutely photographed in the embryo may be enlarged or magnified in its future growth, until clearly perceptible in individual characterizations. Whatever the aggregate of the ever-varying conditions operative in producing such slight and transient modifications of the parental germ-matter, that aggregate may be stamped upon the embryo at the moment of conception; subject, of course, to the slower and less potent influences ordinarily operative in the production of acquired modifications. This theory of individual variation is supported by the descent from parents to children of certain pathological modifications, such as happen to be well-marked or in the ascendant in the father or the mother, or in both immediately before, or at the time of conception. In fact, the theory is acted upon by all intelligent breeders of domestic animals. They would not expect to see well-developed young come from a parentage in whom there was a defect or a state of disease even of a temporary nature in any of the parts essential to organic life. Neither does common sense or experience justify the conclusion that a drunken father can procreate as perfect a child as when sober. In fact, statistics amply prove that such children are almost invariably affected in some abnormal way, or that the transient impression

upon a parent may be permanently stamped upon the offspring. To sum up, we have then, as the conditions precedent to the more stable types of organic life, such as have been in operation for many generations bringing about the gradual acquisition of specific endowments; and by transmission and the stamping of them more and more deeply on each successive generation, they at last acquire a high degree of persistence. On the other hand, individual variations probably spring, not only from the crossing of diverse blood; but, as in the progeny of the same parentage, from the acquisition of some brief and fleeting modifications of the parental germ-matter that coalesces in the formation of the embryo. We do not by any means assume the causal relation as established between permanent conditions and persistent types or between evanescent diversity and individual variations, but only as presenting the most rational explanation of the ordinary phenomena of heredity. And at the same time it should be acknowledged that there are in exceptional instances some startling and anomalous variations not explicable on any hypothesis, unless it be, in some cases, as stated by Darwin, upon the principle of revertence. Now, if there be, as it seems to me quite clear that there is, a relation at least approaching uniformity between the duration of the modifying conditions, embraced in the environment and prevailing habits, and the permanence of the effects upon the organic constitution, it follows that the converse is true, or that ever-varying organic effects are the products of an evanescent variableness of the diversity of the conditions.

In applying this doctrine to the elucidation of the possibility of eradicating abnormal variations, such as taints of blood and defects in the organic constitution of the body, we are confronted by a new phase of organic life, one that has no place in normal variations; to wit, that when such abnormities affect any of the parts essential to organic life, the result sooner or later tends to recovery, or to an untimely end, in death. It would seem in this, as if nature cannot tolerate such abnormities or states of disease; that either the abnormity or her processes must cease. There is here a state of war, of which the end must either be in extinction or in the restoration of harmony and peace.

If we take a comprehensive view of the ultimate causes of these abnormities or diseases it will be found that they apparently consist in an effort of nature to adjust itself to its environment, and to the habits. Thus, when the habits and environment are normal to the body, the outcome is health, when abnormal the outcome is disease. In the one, there is harmony and adaptation, in the other discord and lack of adaptation. This definition has the advantage of including not only the things which act, but the condition of the object acted upon, and the relations of the one to the other. It clearly expresses the practical truth, that what may be a cause of disease, or of health to one, may not be to another; that in short, the greater number of the so-called causes of disease are only such conditionally.

But before going further, let us endeavor to go to the root of deviations from what may be considered a normal standard in the forms and forces of the body. The normal man may be considered as one in whom there is no

trace of taint or of organic defect, either acquired or inherited. If he continues in his natural environment, and by his habits does no violence to himself, the probabilities are that he will not die of disease, or of the failure of one organ to perform its function long before another; but that he will die somatically or nearly so, that is, the decline and decay of vitality will not be organic but molecular, affecting alike or nearly so, every molecule of the body; so that the descent to death will be gradual, systematic, and uniform in all its parts. This is natural death, or death purely from old age.

But suppose that a man and woman of such endowments remove from the environment to which they are adapted to one radically different, and in addition, that they depart, as they are often seen to do, from all their previous habits. Instead of habitually breathing the purest of out-door air, they breathe and rebreathe the stagnant air of a house by day and by night; instead of having the enlivening influence of sunlight and an out-door life, they have the depression of a close and shadowed confinement; instead of plain, substantial food, they have rich and luxurious refinements; instead of regular hours of rest and sleep, they have frequent midnight excitements and morning headaches; instead of pure water to drink, they have impure, or they habitually use some exhilarants; instead of a temperate indulgence of the sexual function, it is goaded into excesses by every possible device; and instead of allowing the reproductive function to take its natural course, it is interfered with in various ways to obviate the care and vulgarity of a larger family. Suppose all this, — and it is no uncommon occurrence, — the tendency inevitably would be to a steady decline of their vital force. During this decline children are born to them, and reared amid the same artificial and unnatural conditions. They pass through the diseases of childhood with difficulty or not at all; at best, the traces of their prostrating influence are seen for weeks or months upon their tender and easily scarred bodies. They grow up into adult life: thinner, paler, and in every way more delicate than their parents. A long step downward in the stock of constitutional vigor has been made, and, as often happens, new acquisitions of degeneracy are made, such as arise from yet freer dissipations even during the tender and critical period of rapid growth; and, with the addition perhaps of the syphilitic taint. Their parents have started them on the downward grade, nursed them in it according to the requirements of fashion all through that period of life when the impressibility of the system is at its acme, and the children continue to add to the force and swiftness of the descent by excesses and indulgences perchance even greater than those practiced by their parents. These children marry, it may be, those as low in constitutional vigor as themselves; the second generation is started on a yet lower plane of vital force, the degrading process is continued upon their offspring until scarcely a trace of their sturdy ancestry remains. I need scarcely add that this degradation of the vital and organic force is far from uniform; on the contrary, it presents an infinity of variations, being sometimes thus rapid, oftener slow; sometimes it is temporarily arrested or even reversed; here, it is made to take a special direction, spending itself on some particular organ; there, it is modified by the crossing of bloods, the grand outcome of which is an almost

unlimited diversity of taints and of degrees of weakness, or of defects in some or in all of the organs essential to healthy life. Now that we have seen how the constitution is broken, how shall it be mended? Here the law mentioned above comes to our aid, that all diseases of fundamental organs tend more or less quickly to extinction or recovery. But though recovery take place, there are yet almost invariably left traces of an organic weakness or defect; and this in the great majority of instances is the ordinary way in which defects originate, to be afterwards transmitted from generation to generation. Though these are much more permanent and indelible than their immediate cause, — an active state of disease, — there are no real grounds for supposing that they are more so than the causes which produced such diseases. We are all familiar with the eminently resisting power which some persons have to disease-producing conditions. In such instances though the characteristic effects or disorders of the unfavorable condition may be long deferred, they are very sure to appear at last, and often somewhat suddenly. All experience, however, is opposed to the assumption that it is only the last straw laid on that broke the back of health, but on the contrary that it was their gradual accumulation which overcame little by little the inherent resisting power of the constitution. This being a work of time and slow imperceptible degrees, the process does not properly come within the province of the physician but of the hygienist. Even so is the removal of or the recovery from the defects and weaknesses left by disease a work of time, and by imperceptible degrees, and the process lies within the province of the hygienist rather than of the physician. The hygienist, therefore, has to prolong his vision further into the past and further into the future than the physician, his aim being either to render the services of the latter unnecessary, or to supplement them after the disease is removed.

No one now disputes that the hygienist can direct how the formation of organic defects may be avoided, but the general conviction is neither so clear nor so strong that when once formed, the hygienist can direct how they may be removed; but the specially trained observer, who has carefully considered etiologies, physiological as well as pathological, has no more difficulty in apprehending the possibility of bringing about the exodus quite as surely as the genesis of organic defects. It is true, that the genesis is so common, so ordinary, — the conditions being so facile of adoption by the unthinking and the ignorant, — that one has only to study genealogies from the stand-point of the physician to see the process in frequent course of illustration; while on the other hand the conditions pertaining to the exodus of such defects require care, special sanitary wisdom, and self denial, qualities so rare that those who run seldom have the chance of reading. When the process does occur, it is almost invariably, and far more, the outcome of accident than of well-considered design. Thus, the health of a family in a city being badly impaired, they make a permanent removal to some salubrious country district. There is only a vague notion that somehow the purity of the country air may effect a restoration. But with the purer air of the country they are inadvertently led to adopt a change of habits, which is not only very great, it is simply revolutionary. They are led to take far

more out-door exercise than ever before, to live upon much simpler and wholesomer food, to indulge less in stimulants, to keep better hours, to clothe themselves more in accordance with the requirements of nature, and to exercise a better control and more temperate indulgence of the passions. In appropriate instances, the effects of such a change of the habits and environment are often quite marked upon the health of adults, but far more so upon the vigor and development of the expanding lives of the young. The latter, under the continued influence of such circumstances, have a steady tendency of revertence to the normal type of organic development, of health and of a normal longevity. To say that this is not the tendency of such a change is simply to say that there is no virtue in it, that the improved state of health is only a barren ideality, and that the process of recovery from organic taints or defects always stops short of eradication. That it so frequently does so, must be laid, not to the tendency of nature, but to the lack of a wise and continued adaptation of means to ends.

The improvement of the health under the above named circumstances may not, however, be uniform and continuous, owing to the fact that the change of the habits and environment may not be sufficiently radical, or that the change was not adapted to the erasement of some peculiar diathesis. As before intimated, so great is the prevailing ignorance as to what constitutes the true conditions of health, that it is more a matter of chance than of design whether the means are adapted to the end or not. All the danger to life may lie, as it very commonly does, in some special organ, — which has long had to bear the brunt of some special infringement, whereby its vital autonomy has been greatly impaired. The raised tone of the general health through better hygienic surroundings, will, with considerable certitude, effect a temporary improvement in the action of the part organically deficient, even though the precise habits or conditions which produced and kept it up are continued. Yet, as in the influence of a systemic tonic, the respite from organic derangement will only be temporary. No one with any claims to medical accuracy pretends to assert that pulmonary consumption is a strictly transmitted disease. All certainly known on this point is, that the descendants of those who have died of consumption are more likely to die of it than those not so descended, and that the descendants and ancestry die of it at about corresponding periods of life. It is therefore assumed that the disease, *per se*, is not directly transmitted, — only the predisposition to it; and, that this may have its only expression through many years, in a more or less well-marked pulmonary weakness, or liability to derangement from exciting causes of a very trivial nature. Only by a careful scrutiny of all the conditions observed as pertaining to the acquisition of tuberculosis can we arrive at a true insight into its essential causes, — and hence of its prevention. The conditions of its genesis are so varied and so complex, — embracing not only the inhabitants of every clime, but their subjection to habits almost as diverse in nearly every particular as it is possible to imagine. A careful survey of all the causes that long observation has assigned as productive of consumption, warrants this generalization, — that whatever cause or class of causes tends to undermine the health and strength, also

tends to form or favor the genesis of the disease. Yet, no group of such causes can be assigned as the essential ones, else the production of the disease would follow, other things being equal, wherever they were found to prevail, with logical precision.

In addition to all the conditions predisposing to the genesis of the disease, it is at least reasonable to conclude that there must be some specific *determining cause*, or causes, to give rise to a type of disease so specific in its nature. And this specific cause or causes must in their operation be as world-wide as the disease, — not simply and apparently sufficient to account for the prevalence of the disease here or there, but everywhere. The only safe method of reasoning under such difficulties is by that of elimination, or, by casting out first one, then another and another condition as not being invariably present with the effect, and therefore not in the uniform relation of an antecedent to a consequent. It will be understood that in the phenomena of ordinary disease, antecedents and consequents do not stand in an invariable relation to each other; that is, even exposure to the most clearly ascertained causes of a disease may not be followed by its characteristic effect; and this arises from the varying condition of the medium, or of the instrumentality acted upon. Yet this in no way invalidates the doctrine of specific causes, else we would be forced to the conclusion that because the intemperate use of alcoholic drinks is not always followed by delirium tremens, therefore it is not its specific cause. Precisely in this as in scores of other diseases, the influence of the specific cause requires to be aided by the predisposing, before the characteristic effects become manifest.

Nearly all the standard medical writers of recent date have avoided any attempt to designate a specific cause of consumption, and content themselves with a simple enumeration of the group of causes exciting and predisposing which experience has demonstrated are most frequently associated with the development of the disease. The task cannot be said to be difficult, nor can it be said to be particularly valuable in any practical results. If, with Dr. Fuller, a step further be made, and the view entertained that the conditions invariably antecedent to the formation of tubercle are defective vital formative power, an impoverished blood, imperfect assimilation, and general mal-nutrition, what has been gained on the question of its etiology and prevention, unless the cause or causes of these prodroma are themselves made known. Without having the temerity or presumption to suppose that limited observation and inferior abilities can accomplish more in this direction than superior, I yet venture the attempt of showing that at least a special value should be placed upon a single element in the genesis of tuberculosis; and should the attempt be successful, it will be a long step in the direction of putting a limit upon the ravages of the disease. If the assumption be made that the leading factor in the genesis of tubercle is the repression of the normal action of the skin by climatal vicissitudes, the position cannot be maintained, for *cæteris paribus*, there is no uniform relation of the prevalence of the disease to such vicissitudes. Another theory, that bad drainage plays an essential part in its production, cannot, for the same reason, be sustained, the disease prevailing to a large extent in some of the

best-drained countries of the world. The cause or causes, whatever they are, must be in very general action the world over, as tubercle is the most uniformly diffused disease to which mankind are subject. In pondering upon this subject for many years, I have been led independently, and by a somewhat peculiar route, to a conclusion, in reference to what constitutes the leading factor in the genesis of tubercle, precisely similar to that entertained by some eminent men, among whom Dr. McCormac, of Dublin, is a well-known representative.

Whoever studies personal hygiene closely, cannot fail to be impressed by the frequently observed fact that the organ which receives the *onus* of the violation of sanitary law will be the part most likely to become diseased. Thus, the burden of unwholesome foods and gluttony falls wholly on the stomach; that of alcohol, tobacco, and brain worry, mainly on nerve-tissue; that of excessive venery, on the reproductive organs; that of eye-abuse, on optic structure; and that of habitual privation of air and light, across the sinciput, or the loss of life in the hair of that region. The universal plan of interfering with the great mobility of the atmosphere whereby unwholesome accumulations are prevented, as in boxing up in rooms a few hundred cubic feet as tightly as possible in which to live and move, results in our taking into our lungs about 10,000 times each twenty-four hours a quality of lung food which is more than impure, — it is weak and devitalized. If half of the food taken into the stomach was of such a quality, the most ordinary experience would be competent to decide that it would be hurtful, not only to that organ, but to the strength of the blood and of the system at large. Yet, nature is far more urgent in her demands for lung than for stomach food. She must have the former every minute, almost every second, or perish. The act of expelling air from the lungs sixteen times every minute should be regarded as *excretory*, and the expired air as an *excretion*, almost as unfit to be again taken into the body as the excretions of any other organ. But such is the force of life-long circumstances and habits, that this thing is continually done, especially during the night, by all classes of people; and when, as a consequence, the lungs — upon which the *first impress* of the infringement falls — suffer, and the strength perishes, they seek to lay the blame on some natural or providential cause. This abuse of the lungs, so far as I can ascertain, has an uniform relation to consumption. As an antecedent, it is the only one which makes any approach in uniformity to the consequent tuberculosis. Almost, if not all, the known causes of disease can be eliminated from its genesis except this.

Give the lungs pure food throughout the day and night, — not a thousand times only, but twenty-two thousand times, — and strength and health to the parts would displace weakness and disease. Every inhalation of corrupted air into the lungs is a blow at their strength. After a time they are likely to fail, and become diseased precisely as the stomach is likely to fail by abuses inflicted upon it, or as the nerves are likely to fail by abuses inflicted on them. In the one as in the other, some are so strongly constituted that they can resist the evil influence for years or for a lifetime; but in those not so constituted, or in those in whom it is powerfully aided by other life-

depressing conditions, and especially in those in whom the lungs are organically frail, is tuberculous disease of the part a frequent resultant.

The recorded instances of the coördination of any impure lung food and a great prevalence of consumption, are numerous and instructive. I shall only adduce two. Dr. Parkes' "Manual of Hygiene," page 9, says, "a great amount of phthisis has prevailed in the most varied stations of the army, and in the most beautiful climates, in Gibraltar, Malta, Ionia, Jamaica, Trinidad, Bermuda, etc., in all of which places the very common condition was the vitiated atmosphere which our barrack system everywhere produced. And, as if to clinch the argument, there has been of late years a most decided decline in phthisical cases in these stations, while the only circumstance which has notably changed in the time has been the condition of the air," by an improved system of ventilation. Dr. Aitkin, who uses the word scrofula as a synonym for tubercle, says, "The broadest fact established regarding the exciting cause of scrofula is, that the domesticated animal is more liable to scrofulous disease than the same animal in a wild state. The stabled cow, the penned sheep, the tame rabbit, the monkey, the caged lion, tiger, or elephant are almost invariably cut off by scrofulous affections, no doubt due to deficient ventilation and the prevention of natural exercise and consequently of healthful respiration. — "Science and Practice of Medicine," page 234, vol. ii.

Giving all these facts their due weight, has the method obviously suggested of eradicating an innate tendency to this disease ever had a fair test? I think that I may fairly say that it has not. I have yet to meet with a single family, every member of which has had as pabulum for their lungs, day and night, winter and summer, and from infancy to mature life, air even half as pure as that to be found in the streets; on the contrary, from half to one fourth of the time their lung food has corresponded to that found in houses, being excreted air in a more or less dilute form; and this is the kind of aliment on which the lungs have been largely nurtured all through life. The rule is even far worse among those who have any reason to fear a tendency to consumption. Utterly oblivious to the self-evident truth that by the expulsion of air from the lungs, after a momentary contact with them, nature plainly declares such air to be no longer fit to sustain life, they cause to be taken into their lungs as sustenance for them that which has been excreted not once only but twice or thrice. And this excretory impurity constitutes a half or even three fourths of the nutriment received. Surely a better way of nursing an inherited weakness in the respiratory organs, and of developing this weakness into disease, could not be devised. Let this stupid system of supporting weak lungs, and of attempting to restore them only through the stomach, be abandoned; let them receive good, pure, appropriate pabulum, such as nature furnishes freely and abundantly, not ten thousand times a day only, but twenty-two thousand times, and this all through life, and strength and health of the lungs will supplant a tendency to weakness and to disease. If the most ordinary non-medical judgment is competent to decide that a weak stomach cannot possibly gain strength from food which is nine tenths impure or unwholesome, certainly the most ordinary profes-

sional judgment ought to be able to decide that the lungs cannot gain strength when their food is nine tenths impure and unwholesome. Other collateral means of aiding in the eradication of a pulmonary weakness or defect should not be neglected. The most ordinary experience tells us that any one leading function of the body imperfectly performed, involves more or less derangement and weakness of the system at large. But while this is true, by far the most important, the most essential point, is not to injure but to fortify, not to debase but to exalt the strength of that structure which is organically weak or deficient. And, just as certainly as we observe that a weak, stunted plant imbedded in an inappropriate soil at once shows a healthy vigor when transplanted to an appropriate one, so will weak and defective lungs show strength and health when there is passed to them through all the stems of the bronchia an intermittent stream of the pure and appropriate pabulum which they require during every moment of life.

Having thus attempted to particularize in a single yet prominent example the method by which an acquired and perpetuated organic defect may be overcome, I have only to say, that, as sanitarians, we have simply to apply the methods which the most thorough knowledge of hygiene suggests as appropriate to the eradication of any other hereditary defect, in order to render man's triumphs over the evils of his own nature, as notably conspicuous as those over the outer world, of which he is becoming more and more the monarch.

HEREDITARY ENTAILMENTS IN DOMESTIC ANIMALS AND IN THE HUMAN FAMILY.

BY JAMES LAW, D. V. S.,

Professor of Veterinary Science, Cornell University, Ithaca, New York.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 12, 1875.

It is conceded that the hereditary transmission of ancestral qualities is fundamentally the same as the reproduction of cells or nuclei in the individual. The true phenomenon of heredity is indeed manifested in the continuous development of these centres of nutrition throughout the entire life of an animal or plant. The nuclei of muscle, striated or plain, do not fail to reproduce themselves and build up through their descendants the same kind of muscular tissue which they themselves have spent their time in elaborating. The bone cells produce bone cells only, the marrow cells marrow, the white fibre cells white fibre, epithelial epithelium — globular, columnar, tesselated, or scaly, according to their ancestry — the nerve nucleus, nerve nuclei, and so on through the whole list of textures, until we could fancy we are dealing with different races of men, animals, and plants, and the maintenance of their genera and species.

The identity may be carried further, and we may study in these cells the evolution from one type to another in accordance with a change in the conditions of their life, or the progress of the body of which they form essential elements. We may trace the cells of the cartilaginous elements of which the solid framework of the body is at first composed, changing their functions in accordance with the demands of advancing life, and building up a structure no longer of yielding gristle but of solid bone. We see the simple epidermic cells, according to the exigencies of the system, developing hair, bristles, feathers, or horns. And we see the inactive spherical epithelium of the mammæ suddenly commence to reproduce themselves with the most marvelous rapidity in the secretion of milk. We thus see not only direct transmission of qualities, but also latent powers preserved through many generations of cells, as of individuals, to be manifested in due time as causes of variation, improvement, or decay.

If we alter the conditions of surrounding things we promptly modify these cells. An abundant nourishment will cause increase of size and more rapid reproduction. Starvation will reduce the bulk and restrict the increase. See the rapid growth of the well fed and active muscle and the no less rapid wasting of the paralyzed and famished one. Impair the integrity of these cells by the introduction of an irritant, and we find the same cells rapidly growing and increasing in numbers, it is true, yet no longer building up

their natural products but producing rather pus, cancer, or tubercle, or elaborating a product lower in the scale of organization; the cells of nerve or muscle producing those of fat or white fibrous tissue, those of white fibres depositing earthy salts, or those of epithelium, pigment, hair, or horn. We find here a microscopic view of the animated universe with all its living bodily forms, its continuous generation of the same types and patterns, its variations, developments, and degradations under the influence of foreign causes, and its advance or retrogression under the direction of fixed laws.

HEREDITY IN THE ANIMAL.

The germ of the future being differs from these plastic unclear elements mainly in this, — that it is the product of two essentially distinct bodies, implying far greater opportunities for variation, and that the single cell contains within itself all the plastic energies necessary to the successive and harmonious evolution of the tissues of the fœtus and of the frame at all subsequent stages of life.

The doctrines and laws of heredity in cell-life have received abundant attention at the hands of the histologist and pathological anatomist; and the principles of inheritance have been closely studied and availed of in the improvement of the races of the lower animals; yet it must be confessed that the same principles and laws in their bearing on the progress of the human race have been most unaccountably and undeservedly neglected. This may be partly charged on the modifying influence of education in man, which partially invalidates some laws that are all but invariable in the brute, and has too often led to the conclusion that heredity, as applied to the elevation of the human race, is unworthy of confidence. Yet how partial is the influence of education alone on the individual, may be perceived from the many wrecks of social communities founded on the assumption that the mind of the child is like a blank page, on which we may draw whatever lines we choose and present a picture of unmitigated evil or good, according to the training from birth. To reach the truth on this subject we must discard all exclusive theories of the omnipotence of birth-right qualities on the one hand, or of education on the other. We must realize that when an individual comes into the world there is a limit set by heredity on his breathing, digestive, muscular, and nervous powers, beyond which he can never hope to advance; but we must not forget that the fostering and training of these various faculties will not only advance them to their highest possible development in this particular subject, but will enable him to transmit to his immediate progeny a further development of the organs involved, and possibilities of reaching a higher level than had been attainable by him.

Bearing in mind this vastly increased power of education in producing variations in man as compared with the lower animals, and especially in regard to the nervous and mental faculties, we may profitably deduce from the principles relied upon in breeding the domestic animals, data which may be applied for the amelioration of the human race.

TRANSMISSION OF PHYSICAL TRAITS.

The hereditary transmission of physical traits as manifested in the maintenance of species and varieties with all their excellences and defects is universally recognized, and will demand no extended statement nor argument. The maintenance of different types of the same species in one locality for a long series of generations, in spite of all the modifying influences of their environment, is perhaps not so constantly realized, but speaks with far greater force to the power of heredity. The following may serve as examples: The rich pastures of York, Durham, and Northumberland, which contributed so much to the origin and preservation of the famous short-horn cattle, continued to harbor as well the "lyery" or black-fleshed breed, — a race as despicable as the short-horns were excellent, and that never failed to deteriorate that blood irreparably when crossed upon it. The midland counties of England still maintain as native breeds, the long-horned Hereford, and the polled Suffolk cattle, the coarse-fleshed and long-wooled Leicester and Lincoln, and the handsome, sweet-fleshed, and fine-wooled Down sheep. One and the same county develops in equal perfection the thoroughbred racer, and the slow but powerful draught-horse; nor does the lapse of time give promise of the modification of any two of these by surrounding circumstances, so that they shall merge into one intermediate breed. Identical instances are not wanting in the human family. In Brittany there have long existed two distinct peoples; the sturdy Breton and the weak, degraded Cagot. In Northern Europe, in the same latitude, we find the strong, intelligent Norwegian and Swede, and the dwarfed, stupid Lap. In South Africa, the bold and vengeful Caffir and the gentle, docile Hottentot. In Hindustan there are the different castes, varying in physical and intellectual qualities as much as in rank. Over the whole world, nearly, we find Jews and Gypsies mingling with all sorts of people, but never losing their national or family characteristics.

The possession of this *prepotency* is so important as to warrant an investigation into the causes which procure it for the family or individual.

CONDITIONS WHICH STRENGTHEN PREPOTENCY.

Leaving out of sight the surrounding circumstances, which may favor the persistence of one type rather than another in a given locality, the alleged or acknowledged causes of prepotency are, —

1st. The fixing of characters in a family by long continued breeding to a given type.

2d. The preponderance of one parent over the other in personal vigor.

3d. A marked variation from the ancestral type without the intervention of *Atavism.*

1st. Prepotency is universally recognized as preserving the types of all pure breeds, and especially of wild animals, in which variation from the ancestral stamp is almost unknown. Much more striking, however, and more important to breeders, is the power of perpetuating their ancestral and personal qualities in their offspring with a race of less fixed characters, and of

extinguishing the features of the less favored race in favor of the prepotent one. Instances of this kind are matters of universal experience in the breeding of domestic animals. The English race-horse owes his excellences to frequent crosses, extending through several centuries, of the pure and prepotent Turks, Barbs, and Arabs, on the old heavy horse of the chivalrous ages. The Percheron horse, so much admired for its combination of weight, strength, and speed, is almost certainly the result of crosses of pure Arabs and Barbs, brought by the Crusaders, on the native draught-horse of La Perche. This at least is certain, that when the prized race had been deteriorated by crossing with English and Danish blood, the pristine beauty and value were promptly restored by the introduction of two Arab stallions — Godolphin and Gallipoli — in 1830. Since that period, the extraordinary demand for this breed of horses has led to the extensive introduction of Norman and other mares; and the beautiful Arabian type, already often weakened by injudicious crossing, bids fair to be completely extinguished. Here the crossing of the pure Arab on the mixed breed stamped it with the Arab type, but the subsequent cross of the Norman of comparatively unmixed blood on the mixed Percheron, stamped it once more with the traits of an inferior race. Splendid as the Percheron is, he has been too often crossed to retain a strong prepotency, and it is well known that his crosses upon other breeds mostly lose the Percheron stamp after the first generation.

Short-horn cattle afford one of the best examples of acquired prepotency in a race. One hundred years ago the careful selection and breeding of these animals was begun; and already they have attained to such prepotency that a pure Duke bull has become almost priceless, because of his unerring transmission of personal qualities. A careful and intelligent selection for a few years only has produced in France the Charolais race of cattle, which bid fair to rival the short-horns at no distant date. They are sure breeders among themselves, but lack much of the prepotency of the Durhams, when crossed upon other breeds.

But the most remarkable instance of prepotency is that recorded by Fleischmann of a coarse, hairy-wooled German ram, which was crossed upon merino ewes, and the offspring bred back upon merinos for twenty generations. The ram had 5,500 fibres of wool on the square inch, the merinos 40,000 to 48,000, while the lambs of the twentieth generation which on the principle of dilution should have retained but 1,000,000,000 of the blood of the ram, had but 27,000 fibres to the square inch.

The bearing of this law on the people of the North American continent is perhaps greater than on most other nations. The United States being largely settled by the bold and enterprising from all parts of the Old World, we begin with what are presumptively strong and vigorous elements to build up the nation. But the inevitable crossing which takes place in such a heterogeneous people, the alliance of Celt with Saxon, Norseman with Latin, Oriental with Occidental, Teuton with Moor, Aristocrat with Plebeian, though sometimes favorable to fine physical and mental power, is steadily sapping the fountain of prepotency possessed by the purer blooded ances-

tors, and begetting a people whose high qualities must lose disproportionately, when allied to a more fixed but inferior race.

It may even be questioned whether this weakening of prepotency in the higher race by previous crossing, is not to be placed by the side of atavism in accounting for the frequent evidences of degradation in half castes. In Brazil, and other countries which have drawn upon but one European race, the half castes compare favorably with their white ancestors.

2d. That the more vigorous parent has the greater prepotency is frequently manifested in the domestic animals, and seems to imply a tendency in nature to an improvement or elevation of the type, as far as surrounding circumstances will admit. Thus, the qualities of a particular parent will be transmitted with far greater certainty to the progeny begotten in his period of full development and robust vigor, than to the offspring of his early youth or of the decline of his life. The breeder of dairy cows keeps the dams in full milk, so as to impress the milking qualities on the calves. The horse-breeder keeps up condition and vigor in both parents, and especially at the period of coition, by judicious feeding and exercise. The Arab even mounts his mare and rides her far and fast, to draw out all her mettle, before putting to the horse. The principle here involved furnishes the germ of a system of progress by drawing out to the full all the desired qualities during the period of active reproduction. This, however, must be noticed later.

3d. Ribot says that extreme variation, not the result of atavism, tends to perpetuate itself, and though there are numerous exceptions, as in hunchbacks, distortions, deafness, etc., yet many instances might be cited in which the subjects of such unexplained variations seem to possess a prepotency immeasurably superior to that of the representations of atavism. We may mention the cases of polydactylism in men and animals, which, appearing at first but in one member, repeats itself in two, three, and four limbs in successive generations, though one of the parents was in each case free from the infirmity. The Ancon ram is a remarkable instance of the same kind. He differed from his parents in having an unnaturally long, heavy body, and short legs, which characters he transmitted with unerring certainty to all his progeny. The high standard of short-horn cattle is largely due to the exceptional excellences of some of the earliest, especially Hubback and Favorite, both of which had the power of perpetuating in their offspring the valued variations which marked them as peerless in their kind. So it is with the English race-horse. All great winners of the present day can be traced back to many crosses with the blood of King Herod, Eclipse, and Matchem, stallions which were far in advance of their contemporaries and ancestors. The hornless cattle of South America, as well as families of tailless cats, and fowls, and of blind, *broken-winded*, and roaring horses, may be traced to a similar origin.

It would be easy to cite cases of remarkable prepotency in man, many of them originating, doubtless, in some unexplained variation, and, by the aid of education, maintained for many generations, in spite of continuous crossing outward. Galton gives numerous instances of such mental prepotency

among judges, statesmen, soldiers, literary and scientific men, poets, artists, and clergymen, showing how much more might have been done, could there have been a systematic selection like that pursued by the breeder of animals.

CAUSES OF VARIATION.

But I must hasten to notice some of the more common causes of variation. Of these, the surroundings, as expressed in climate, soil, food, and water, exert important influences.

THE ENVIRONMENT AS A CAUSE OF VARIATION.

Climate affects the body as it does the individual cell. Cold causes contraction of the cell and retards reproduction. Heat with moisture tends to induce expansion and to hasten reproduction. The warm, damp climate, is equally relaxing to the entire animal system, giving a laxity of fibre, a heavy phlegmatic temperament, and a lowered tone and vigor. The arctic climate causes shrinking of the surface and dwarfing of the entire body, though within certain limits cold braces and gives a closer texture, a better tone, and an increased vitality. A temperate or genially warm climate with a dry atmosphere is alike favorable to perfect bodily development, a vigorous nervous temperament, and an elevated tone and vitality. This is abundantly evident in the case of horses. The best native breeds, and the ancestors of the most esteemed modern races, are those of Western Asia and North Africa, where a dry clear genial atmosphere prevails. The poorest are those of the hot, damp, malarious regions of Eastern Asia, Hindostan, Malabar, and China. In Western Europe we find a heavy, lymphatic, coarse-haired and flatfooted horse in the Netherlands and the west of England and Scotland, while we see finer skinned and cleaner limbed representatives of the same class in Spain, and on the dry east coast of Great Britain. In keeping with this, we find that certain diseases pertaining to heavy, lymphatic animals, and damp cloudy regions, tend to disappear in the dry, bracing country. Recurring ophthalmia prevails among horses on the low damp land and under the cloudy skies north of the Pyrennees, but the colts carried over the mountains to the dry table-lands and clear air of Catalonia, rarely suffer again, though they may have had one or two attacks prior to removal. Lymphangitis of the hind limbs, prevails on the damp west coast of Great Britain, and is comparatively infrequent on the east. So with grease, canker, and other similar affections.

In cattle we see the effect of the return of genial weather especially in the growth of hair and horn, so that the thickening which appears year by year on the frontal horns has been fixed upon as a means of estimating the age. In Ireland and other damp climates, the short-horns acquire a thicker skin and longer hairy covering. In some warm South American valleys, cattle shed their hair and go naked as a Barbary dog. In the dry, cold winters of our northern States and Canada, the size, form, and aptitude for growth and fattening of the short-horns are only maintained by keeping up a milder artificial climate in-doors.

But above all other epidermic products, wool is modified by climate. The

best wool is a product of a temperate or rather cold climate. In equatorial regions it tends to be shed and replaced by hair, as seen in Antigua and Nicaragua. In very wet climates, also, it is more or less substituted by hair which sheds the rain better, as in Wales, the Scottish Highlands, and the Rocky Mountains. In the eastern and midland counties of England, the fleece seems to require less care and selection than in America.

These changes in the skin and its products are indicative of deeper and more fundamental modifications. How much of the spare habit of Americans is due to the climate; how much of the national nervousness and prevalence of nervous disorders? Why is the cerebro-spinal enzootic of American horses unknown in Europe? For the same reason, probably, that dogs in the extreme cold and dryness of an arctic winter, contract nervous disorders and perish in a state of dementia.

English Southdown sheep lose their compact form, and become more leggy and lank in the United States.

Seeing, then, that it is useless to seek by selection any excellence which is constantly being sapped and undermined by an unfavorable environment, we should endeavor to counteract the spare habit, the loss of hair and teeth, and the nervous tendencies of the modern American, by a greater breadth of forest, which will moderate at once the extreme rigor and dryness of our winters and the intense heats and droughts of summer.

Soil and Food. — The influences of these on the lower animals are so commingled that they can only be partially separated. The richness of the soil implies the excellence of the vegetable product and the improvement of the animal. Poor soils, like Corsica, Brittany, Sweden, Shetland, Iceland, have small-sized animals, as seen in the ponies. In the Falkland Islands a breed of horses have degenerated into ponies within the memory of man. European swine on the same islands have assumed the characters of the wild boar, which they fail to do on the rich pampas of South America. On the contrary, the primary excellence of short-horn cattle and of the improved breeds of English sheep, has been largely determined by the rich soil and plentiful pastures of their native regions. The size, even, is believed to be partly determined by the inorganic elements in the soil and plant, and hence the excellence of the short-horns on the calcareous lands of New York and Kentucky.

The food of the human being is usually drawn from a wider area, and hence the soil affects him less in this direction. Yet our experience with the animal is not without its lesson for him. Man suffers from improper choice and bad cooking as much as the brute does from poverty of soil. Nothing will sooner deteriorate man physically and mentally than unwholesome food, with its inevitable dyspepsia and long train of evil consequences. Our present stamina, and future existence, even, depends more upon our cooks and caterers, than is generally supposed. Much of what Tom Hughes calls the "national sadness" may be justly charged upon insanitary aliment.

But apart from the question of food and of a moist atmosphere, the influence of soil upon animal life is enormous. A damp marshy soil, with its

accompanying malaria, provokes a whole army of bilious affections which weaken the native energy, produce dull, despondent views of life, and insure the transmission of a temperament and constitution which is subversive of advancement. Here the civil engineer with his sanitary drainage becomes a most important agent in the elevation of the race.

The influence of water is not to be overlooked as a sequence of the character of the soil and a source of profit or loss to the race. The large frames of animals on calcareous formations are perhaps due to the food rather than the water, but thickening of the cranial bones and disease of the thyroid, are unquestionably produced by the waters of the magnesian limestone. Now, though cretins are unknown with us, goitre is very common in man and beast in many limestone regions, and notably in New York and Pennsylvania. Is there not here a call to the younger members of the race, and especially during the period of active procreation, to avoid this cause of physical degeneration to themselves and their offspring? Then there is the wide question of surface drainage into waters used for drinking or culinary purposes. How often are the drinking waters charged with the germs of ague, typhoid fever, and parasites, or with a variety of septic matter, which if it produces no specific fever nor animal form, poisons the fountain of life, and generates disease in important organs like the liver and spleen.

All alike tend to impair the vitality of parent and offspring, and form important subjects for consideration in the science of heredity to be dealt with practically by the sanitary engineer. He may save tens of thousands of lives annually, and who shall compute the frightful aggregate of ill health, and hereditary weakness which may be obviated in this way.

CAUSES OF VARIATION ACTING FROM WITHIN.

But we turn from the environment to consider those causes of variation which operate from within. And foremost among these stand the influences of active use and disuse as serving to advance or check development and transmission.

The exercise of organs and functions bears a relation to the individual nuclei, and to the building up of tissue, like that held by a rich abundant aliment to the growth of the animal. By the functional activity of an organ, the circulation through it is increased, more nutriment is furnished to the nuclei, and they assimilate more actively and build up a greater bulk of tissue. This has been already referred to as important during the period of active reproduction, as giving the individual prepotency in the matter of these active faculties. But it is no less essential to have all the desirable qualities trained to their highest perfection from early life, that they may receive the fullest development of which the individual is capable. The same person may, by an active out-door country life, develop a splendid *physique* which he will entail on his children, who, if confined to a close, unhealthy room in a densely peopled and insanitary city, would become a weak, thin, cadaverous object, and beget children that are puny, ill-developed, and debilitated.

A fitful or intermittent training is altogether insufficient. The highest

excellence is usually slowly developed. The trotting horse rarely reaches his highest speed until nine years old, though his frame may be fully matured at six. The young blacksmith, who has only been a few months at the hammer, cannot compare his muscular forearm with the magnificent one of the veteran forger.

By availing of the fullest possible development of every individual, we can mould the lower animals almost at will. The short-horn cattle of one hundred years ago were probably the heaviest milkers in England, but by constantly soliciting the production of flesh and fat, by keeping the whole stock continually in show condition, and by neglecting the milking qualities, it has come about that the best short-horns, while attaining to far earlier maturity and to a greater weight of carcase at a given age, are often unable to support their own calves, and these have to be raised on wet-nurses drawn from other breeds. The training of the English racer for many generations has developed such strength of wind and power of continued endurance, that none but thoroughbreds can pretend to compete in a two-mile race, though some hybrids may be found that will make a quicker half-mile dash. Even the ancestral Arab cannot compete on equal terms with his English descendant, but in running for the Goodwood Cup is allowed thirty-six pounds in his favor, or eighteen pounds if only half Arab. The Ayrshire cattle, though bred in a cold, wet county, have had their milking powers developed to their highest possibility by persistent stimulation of the udder, and by a rich artificial diet continued through many generations.

Is it not desirable, then, that systematic gymnastics should form a part of the training of every boy and girl, and should be used to maintain and improve the stamina of every man and woman? This training must be systematically conducted, so as to make up any deficiency in the occupation, and to build up a more and more healthy structure and a higher vitality as the years go by, just as the trotter is brought year by year nearer and nearer to a two-minute gait. Until after personal experience few can realize the increased vigor of mind, as well as of body, which can often be acquired in this way. A member of the Cornell University crew of 1875 had suffered from his earliest years from imperfect hepatic action and a skin eruption, which proved a source of much trouble and annoyance. Under his training these gradually disappeared, and after the race he assured me that he had been amply repaid for all the time, labor, and self-denial expended, by the perfect health acquired, and by his conscious power of mental as well as physical application. If we have our riding-schools and training courses and tracks for horses, will the human race be considered less worthy of care, of training, of outlay? And if in the racer the tightening of the saddle girths by an extra hole, or the poor adjustment of the shoes, will cramp the energies and entail the loss of a race, is it not possible to train men to judge rightly of the hideous deformities and entailed weaknesses continually provoked by the current fashions in dress, and especially that of females? The cramping and displacement of the thoracic and abdominal organs, the atrophy of the structures about the waist and loins, which, of all parts, should be made strong, and the uterine disorders, with their long list of

pathological sequences and mental aberrations, personal and transmitted, are too formidable in their present and future consequences to be winked at without crime. So with the other fashion follies in dress, which are utterly subversive of healthy effort, development, and transmission. Let the dress of man and woman be easy, comfortable, and well adjusted, and let it take its support from suitable points. Let everything be rejected which tends to muscular or bony atrophy, or to visceral displacement or disease. Let each sex cultivate an appreciation or admiration of all that is strong, vigorous, and natural in the opposite, and our hope of physical amelioration may increase accordingly.

As with the locomotor apparatus so with the other organs and functions of the body, but especially those of the brain. Subject to the same laws of development and growth as a sequel of exercise, with other organs, the brain may be made the vehicle of deep and abstruse thought or of high moral principle, only by the continuous systematic exercise of its functions. Without following the phrenologists, or even Dr. Ferrier, in the exact localization of functions in particular parts, we will all agree that the exercise of any faculty will stimulate and increase the group or groups of nerve-cells through which such work is carried on, and that the increase of these groups will confer a greater functional power on the individual, and will enable him, *cæteris paribus*, to transmit an increased development of such groups, with a corresponding increase of ability to his descendants. Thus we have hereditary mental powers, styles of thought, natures, instincts, habits, eccentricities, susceptibilities, idiosyncracies, energies, inanities, virtues, vices, crimes, idiocies, insanities.

We often see the effect of even a temporary habit of mind in the shyness, restiveness, or vice of a foal, the dam of which has been abused and rendered irritable during pregnancy.

The development of much that we call instinct serves to throw light on this subject. We talk of the intuitive fear of man exhibited by wild animals. But this is only seen where man has hunted and destroyed them, and is altogether absent in newly discovered and unfrequented islands. And yet with us the young bird or quadruped flees in terror at the first sight of man, and without the example even of its fellows. The young of domestic animals, on the other hand, show little fear of man, and readily allow him to handle and educate them. The young shepherd's dog takes naturally to the flock, and learns to drive, to turn, and to manage it in answer to the various calls, and almost without training. The pointer puppy, which has never seen wild game, nor received a lesson, will cautiously approach and point at the fowls in the farm-yard. The retriever as intuitively fetches and carries. The deerhound intuitively seizes his prey by the flank and turns it over, the bull-dog takes his by the nose, and the bloodhound by the throat. The race of dogs trained to hunt the peccary adopt of themselves the tactics which their parents have found to be the safest and most effectual. The descendant of the trotting horse naturally takes to the trot; that of the racer to the canter and gallop. But I need not go further. These are qualities acquired by training and perpetuated in the offspring, without education, by the heredi-

tary transmission of the same cerebral development and functional activity. Need we wonder, then, at hereditary mental powers and habits of thought in man? Or need we despair of a steady advancement by judicious alliances, when seconded and fostered by sound educational measures?

In many cases of apparent failure to transmit intellectual powers, the parent has, by mental work or otherwise, undermined his physical health, and the consequent impaired nutrition of the children unfits them for the building up of body or brain in strength or vigor.

Of all forms of mental training the religious and moral are perhaps the most important, and the least easy to deal with. We can make education compulsory on all citizens, but we cannot compel the conscience. The ideas of morality must vary much, according to the religious education, and compulsion here is the worst kind of tyranny. This education is of necessity the work of the family and the church. And if these should fail in their work, our whole boasted fabric of civilization, our high mental and physical status, will dissolve like the baseless fabric of a vision. We need no overrunning with barbarous hordes, no eruption of Huns and Vandals to complete our ruin. The barbarian is constantly knocking at our doors in the form of imperious human passions, which, if misdirected or uncontrolled by a higher law, will override and crush the best mental and bodily powers, and reduce the race to a condition of selfish bestiality. This work of moral training being beyond the sphere of legislation, it becomes all the more imperative that magnanimous and philanthropic men, true sanitary reformers, should, with the self-denial of that great type of all moral perfection — the Christ, — devote themselves to the religious education and moral emancipation of the masses, that they may build up an increasingly true and upright posterity, who shall fear and honor God, and respect the rights of their fellow men.

CROSSING AND ATAVISM.

Atavism is common in the domestic animals, and may be largely due to the fact that our domesticated races are all more or less artificial, and hence less stable than the wild. The black-polled Angus, Galloway, and Suffolk, and the black-faced Southdown sheep, occasionally bear young colored differently from themselves, and which may even grow horns. Black-nosed and even very inferior calves are born in high class short-horn herds. Black sheep appear in the best-preserved white flocks. Leg and shoulder stripes occasionally appear on horses, ponies, asses, and, above all, on mules. This reversion often occurs without apparent cause, but in other cases it unquestionably depends on some change in the environment, or on a violent cross with a different species or a remote family of the same. Baron Nathusius had a Berkshire pig of fine family, which developed all the characters of the wild boar in connection with a digestive disorder which hindered assimilation. The descendants of European pigs, which have run wild in Jamaica and elsewhere, have the body striped like the wild boar. The herds of horses running wild in South America have acquired the ungainly form of the wild horse of Tartary.

The product of violent crosses have long been famed for their stubbornness, wildness, and impatience of restraint. Even half-breeds in the human family are usually in bad odor with the community. But reversion in color appears to be especially common. Crosses of spotted Spanish sheep and white Southdowns and Leicesters produced black lambs, the color of the ancient Spanish sheep. Crosses of red Highland cows with red and roan short-horn bulls produced many white calves with red ears, the colors of the ancient British herds. Dr. Sturtevant informs me that crosses between Jersey and Ayrshire cattle, both fine milkers, at Martha's Vineyard, have similarly produced white calves with red ears and very poor milking qualities.

On the whole, it would seem that in man and animals alike violent crosses are full of danger where both parties to the cross are of a very fixed and prepotent type. But they are not on this account to be absolutely condemned. The resulting reversion is often in one or a few points only, and these of an unimportant character. As an example, the white progeny of the West Highland and short-horn cattle had gained largely in early maturity, aptitude to fatten, and milking powers, and the second and third generations bred back on the short-horn were usually indistinguishable from that breed, except in a superior quality of flesh and milk derived from the mountain ancestor. The first cross even brought a half more for beef than the Highland beast of the same age; and this is the usual result of crosses between short-horns and Ayrshires, Galloways, Angus, and other breeds. An infusion of new blood may thus be a material gain, in spite of an apparent temporary reversion, the crossed race acquiring an accession of vigor and stamina with a new lease of vitality from the blood which at first sight appeared to be dragging it down. Crossing in all cases requires the exercise of good judgment, and should never be risked when the prepotency is on the side of the inferior type. Had the sweetness of flesh and richness of milk been undesirable results, the West Highland would have proved destructive to the excellence of the short-horn by engrafting these upon him.

In man it has been held that the more perfect race finally prevails; but much will necessarily depend on the relative amount of the two races which contribute to the successive generations, and how much climate, wealth, education, and other influences come in to affect the type.

CONSANGUINEOUS UNIONS.

The effect of consanguineous unions on the human race should receive some elucidation from the experience of breeders of animals. That it may be made to subserve to the highest physical development is undoubted. The English race-horse, the short-horn, the Leicester and Cotswold sheep, are a few out of the many splendid results of close breeding. In all of these, the union of brother with sister, father with daughter, and grandsire with granddaughter, have been again and again resorted to, to fix and perpetuate the most valued qualities. That the esteemed qualities have been preserved, strengthened, and increased in this way there can be no doubt, but there can be just as little doubt that any inherited weakness or disease has been often transmitted and even intensified. I could mention partic-

ular families in our highest priced breeds in which tuberculosis has become a fixed character. In others rheumatism is extremely frequent, in others recurring ophthalmia, etc. But I know of little in the lower animals to support the commonly received opinion that consanguineous unions are productive of deafness and deformity. The tendency to sterility, or at least to sexual incompatibility with near relations, is the most prominent result. Many short-horns fail to breed with relations, but are fruitful with other breeds. The still existing herds of ancient British white cattle do not produce more than one calf to five or six of the adults yearly. But swine especially fail in reproductiveness when closely bred. Lord Western bred a family of Neapolitan pigs together till fecundity ceased among themselves, though they still remained fruitful with strangers; and their descendants are the now famous Essex breed. Wright put a boar to seven successive generations of his female offspring, with the result of steadily increasing sterility. In the seventh generation the litter consisted of a single sow, the finest of her race, which proved sexually incompatible with her own sire, but quite prolific with a strange male. Nathusius and others have had precisely the same experience, and the point is thoroughly established. The breeders of domestic animals are now well aware of the tendency, and though they have often adopted the closest breeding for several generations to fix a much-coveted quality, yet they bring in at the earliest possible moment a member of the family which has been bred apart for several generations and preferably under the influence of another soil and climate. Excessive weakness and stupidity of the young is another common result of *in-breeding.*

Whether all this has any bearing on the question of the propriety of marriages between cousins, it may be judged rash to assert. In my own limited experience I have met with a number of instances of webbed digits, and other slight distortions, deafness, eccentricity, and idiocy in the offspring of cousins. On this, as on many other subjects, statistics are liable to misguide us. If we could eliminate from these all cases in which the constitutions of the wedded cousins had been modified by birth and residence in different localities, climates, etc., we could judge better by the remainder how far the results in the human subject agree with those seen in the lower animals.

STRONG MENTAL IMPRESSION ON THE PREGNANT FEMALE.

This is very generally discredited as a cause of variation in man, but in the lower animal so many instances can be adduced that it is impossible to ignore or deny it. In 1849 the whitewashing of the cow-houses at Sittyton, Aberdeenshire, increased the customary number of white calves by twelve times. The same happened to a short-horned herd in Yorkshire, in the same year. A herd of black cows, kept for safe preservation of the type on an island in Buzzard Bay, had a dun steer introduced among them by accident, and next year every calf had a dun color. A polled Angus cow, pregnant by a bull of the same breed, but grazed with a black and white horned ox, had a black and white calf which grew horns. Another Angus cow, grazed

with a yellow and white ox, dropped a calf of the ox's color. A bay mare, with black legs and white star in the face, covered by a horse of the same color, but pastured beside a black gelding with white legs and face, straight hocks and long pasterns set on at right angles to the hoofs, had a foal the exact counterpart of the gelding in form and color. A fine mare at Ithaca, put to a superior horse, but kept in a park adjoining one occupied by a mule, had a foal with unmistakable mulish traits in head, ears, neck, and thighs.

The most reasonable explanation is, that there occurs a modification of the vital processes in the placenta, and indirectly in the fœtus as a result of mental influence. If John Hunter could produce congestion and redness in any part of his skin by merely concentrating his attention upon it; if the subjects of hæmatidrosis can bring on a bloody sweat at will; and if the sudden passion of a nurse will render the milk poisonous to the infant, is it incredible that fright, horror, strong liking or dislike, should modify the placental nutrition and entail the transmission to the fœtus of cells or nuclei which have their plastic energies more or less modified, or of agents which will modify the fœtal nutrition?

In woman, as in the lower animals, this tendency will of course vary according to the personal susceptibility, being *nil* in many, while in some it is marvelously powerful. It is probable, too, as claimed by Ribot, that education will weaken the impressibility, and by filling the mind with many thoughts, will draw attention from the one which would otherwise prove engrossing. Besides educating, we should seek to surround the pregnant female with objects of beauty and worth, and help her to draw grand and noble inspirations from nature and art. Above all, we should seek to banish from her sight and thought all objects that inspire dislike or horror, and such as being uncouth or distorted, have a special fascination for her mind.

EFFECT OF A FIRST IMPREGNATION ON THE OFFSPRING OF SUCCEEDING PREGNANCIES.

It is a well established truth in breeding animals, that the sire of the first offspring tends to stamp his characters on the next succeeding progeny. Lord Morton bred a hybrid between an Arab mare and a quagga, and the two following years put the same mare to an Arabian horse, but the foals showed the dun color, leg-stripes, and bristly mane of the quagga. A fourth foal, bred three years later, still bore marks of the quagga. The same has been habitually noticed in the after-produce of mares which have once borne mules. A number of foals at Hampton Court, sired by Actæon, bore a strong resemblance to Colonel, by whom their dams had been served on the previous pregnancy. The same tendency is notorious in cattle, sheep, swine, and, above all, in dogs. Dr. Chapuis even asserts its prevalence in pigeons.

The explanations usually given are: 1st, that it is the effect of imagination; 2d, that it is due to the influence of the first embryo on ova then in process of development; and 3d, that it is an instance of *pangenesis*, plastic granules from the fœtal blood migrating into the mother's, and remaining

latent there until the next pregnancy, when they pass into the fœtal blood and help to build up the embryonic tissues. But a simpler and more satisfactory explanation may be found. It is a well-known pathological fact that adjacent cells tend to engraft their plastic or formative powers upon each other. I prick my skin with a needle. Immediately the injured cells and nuclei undergo a rapid increase in size and numbers, but the effect does not end there; those adjacent take on a similar action, and the extent of the resulting inflammation is only limited by that of the injury and the susceptibility of the parts. Again, in placing a slice of epidermis in the middle of a raw sore we inoculate the cells of the adjoining granulations, and empower them to develop epidermic structure. How, then, can we avoid the conclusion that the impregnated ovum impresses its own characters on the mass of the decidua, and through this on the maternal placenta, and that this in its turn impresses its characters on the decidua and embryo o the next succeeding conception?

This will perfectly explain the infrequency of the occurrence in the human subject as compared with the lower animals. In the mare the villi of the chorion pass into the uterine follicles and glands over the entire surface of the womb. The points of attachment, therefore, in successive pregnancies are the same. In the virgin ruminant, the womb is studded with button-like processes to the number of fifty or sixty, containing the uterine glands and forming the points for attachment of the chorion in all cases alike. In the sow each chorion is attached to the whole adjacent uterine mucous membrane as in the mare. Lastly in the bitch, each chorion has a broad circular villous belt embracing almost its entire surface, and connecting it to the mucous membrane of the womb. In all alike the connections of the chorion with the uterus are so universal or so identical in successive pregnancies, that engrafting or inoculation between uterus and decidua, and between the last and the ovum, cannot fail to take place. But in woman — in whom the placenta is confined to a small part of the uterine surface, and more likely than not to a different part in each successive pregnancy — this engrafting of the characters of a former fœtus is altogether unlikely, or at least uncertain, and as a matter of fact the result is only exceptionally seen. Were the effect due to pangenesis, as Darwin believes, it would be as common in man as in the domestic animals. The same doctrine of pangenesis would forbid the transfusion of blood into an anæmic patient, lest he should thereby lose his identity, or perhaps even his species or genus. But no such terrible conclusion is necessary, since all the results exactly correspond to the mode of connection of the chorion, and the doctrine of cell inoculation by contiguity will perfectly explain all.

Occasionally it will be found that the children of a woman by a second marriage resemble those of the first, but the occurrence is very exceptional; and I have been thus particular in going into the subject not so much because of its inherent importance as to explain the wide discrepancy in results in man and animals, and to deliver heredity from the charge of caprice or uncertainty.

DISEASE AND ACCIDENT.

Of disease and accident as causes of variation little need be said here. The hereditary nature of even acquired tubercle, scrofula, cancer, rheumatism, gout, dyspepsia, liver disease, urinary calculi, asthma, brain disease, etc., are too well recognized to require notice. Many of these can be counteracted and prevented by suitable hygiene, and thus the tendency to their development in future generations weakened. But alliances between two victims of similar or inter-dependent maladies, are ever to be discouraged as tending to a dangerous or fatal intensifying of the affection. And here the advice or sanction, or even the silence of a family physician or friend, may be a matter of the gravest responsibility.

In the gravest of all cases, — that of mental disease, — nature herself takes the matter in hand, idiots being usually impotent; and in other forms the civil law places a similar restriction on the transmission of the sad heritage, many victims of states prisons as well as of lunatic asylums, being the victims of hereditary imperfection rather than of acquired personal depravity. But beyond these there is an immense class who have inherited and will certainly transmit grave physical and mental ills, if nothing can be done to check it. Oh, for the power to select here as we would in breeding animals! But we can do little more than to seek for the subjects the most favorable hygienic surroundings, with an intellectual and if possible a moral discipline, which shall tend to build up a strong and evenly balanced brain, and one less likely to work in an unhealthy channel.

In one respect our experience in breeding animals may furnish a profitable suggestion. Lesions or diseases, which are painful or active during gestation, are more likely to be perpetuated in the offspring. A horse, affected with heaves or roaring, is more likely to transmit a strong tendency to the disease than he would be before the attack, though his conformation predisposed him to suffer. Horses suffering from recurring ophthalmia, which reappears at short intervals, almost always transmit the disease, as many American horses sadly testify. Even accidental injuries to the eye will affect the progeny, as in the case of a mare at Dryden, N. Y., which suffered during pregnancy from a violent ophthalmia, induced by a burdock in the forelock, and dropped a filly with the corresponding eye abortive. The mare recovered, and has since borne several sound foals, as has also the one-eyed filly. Similar instances might be adduced of diseases of the feet, bones, horns, etc., causing similar defects in the offspring of that pregnancy.

VARIATION FROM OTHER CAUSES.

Other variations are found to occur from disease in the ovum; as when the eggs of birds are hatched standing on one end, punctured, shaken, or partially varnished; or when from excess or deficiency of development, or mechanical injuries, monstrosities and distortions result. These variations, as well as others arising from hidden causes, often become more or less permanent, and their lesson is self evident.

CONCLUSION.

In conclusion we have learned from the intelligent breeding of domestic animals: That heredity is a law that will be executed rigorously in all cases in which we can exclude disturbing causes or such as tend to variations.

That this holds most strongly in the case of characters which have been long fixed in the race, but is true also of those formed by individual variation from the ancestral type, whether originating from accident or disease, from a change in surrounding circumstances, or in conditions working primarily from within.

Even the reversion to a long-lost type of the race, from a violent cross or otherwise, is but a manifestation of heredity, which is further illustrated by its maintenance in the offspring.

Heredity may even be employed to account for those variations which are the result of a strong or persistent mental impression in the mother. Here we have but an instance of the familiar control of nutrition by nervous action, which, failing appreciably to affect the maternal system that had already passed the period of developmental change, operates rather through the placental nutrition on the embryonic tissues of the fœtus.

Lastly, in regard to education which is thought to invalidate the law of heredity. We have seen that education does not abrogate the law, but clothes it with a new power by which it can work toward an improvement and elevation of the race. We see this in the acquired instincts and habits which have become hereditary in the lower animals; and we cannot doubt that the same holds good in the human animal in similarly favorable circumstances. This, indeed, is well established in regard to music, painting, sculpture, logic, versatility, etc. It is true that heredity is to a large extent masked in man, by the extraordinary power of education, in transforming the intellectual and moral being; but this only enhances the possibilities of progress, since the status and activities of the educated man, if not attained at the expense of his physical system, are entailed on his offspring, giving them a vantage ground over the parent, which may be more and more improved in successive generations by the educational process.

Our object, then, should be to improve the health, and bodily, mental, and moral stamina of the young, — such as are the heads of families or about to become so. To this end attention must be given to all that will ameliorate the sanitary conditions of the country or locality; the climate, soil, water, vegetation, food, and its preparation; in our houses, in large cities especially, and everywhere in our schools, churches, and places of public resort, to see that all the advantages of pure air, free light, perfect drainage, suitable sites, etc., are secured; to see that by healthy exercise and training, the whole of the faculties, physical and mental, shall be fully drawn out; and finally that, if possible, all shall be crowned by a well-trained conscience, guided by sound moral laws, scrupulous to right and truth as regards others, and to purity and holiness as respects the person himself. I put this last because a lapse here is sooner or later fatal to all excellence. We may

sin ignorantly against the laws of our being, and we shall suffer in a degree commensurate to the importance of the broken laws, but when we are consciously unfaithful, we have begun to undermine the whole noble fabric, have paved the way for moral anarchy, for the rule of the passions, and for both mental and physical decay.

THE RELATIONS OF THE EXCESSIVE OR HABITUAL USE OF ALCOHOLIC DRINKS TO THE PUBLIC HEALTH.

By HOMER O. HITCHCOCK, M. D.,
President of State Board of Health, Michigan.

ONE of the facts which cannot fail to arrest the attention of thoughtful men, is the vast quantities of alcoholic liquors that are manufactured and sold in the United States.

I have availed myself of the following facts as collected from reliable sources by Dr. Chas. A. Story of Chicago: —

"There were manufactured in the United States in the year 1867, 100,-000,000 gallons of distilled spirits, or about three gallons to every man, woman, and child in the Republic."

"Of brewed liquors 400,000,000 gallons, or twelve gallons to each man, woman, and child, in the Republic."

"Of wines 20,000,000 gallons, and imported liquors 20,000,000."

The value of the sales by retail liquor dealers in the United States during the year 1865, according to the report of Commissioner Wells, was $1,483,-491,865, or just about $48 to every man, woman, and child in the land.

It is probable that more than two thirds of the amount of liquors sold by the retail dealers, are consumed for drink, so that it is safe to affirm upon these statistics that the people of the United States drink, on an average, for every man, woman, and child, $35 worth of alcoholic liquors per annum. Now, as the foods and drinks of a people lie at the very foundation, not only of the normal development and healthful activity of the individual, but also of the very continuance of the race, it follows that any article of food or drink so freely used as alcoholic drinks are in this country, must have a marked influence upon the public health.

Careful observations have been made by competent and honest men, as to the effects of alcoholic drinks upon those who use them, either habitually or excessively.[1]

[1] The experiments of Dr. Bocker, confirmed by Dr. Virchow, prove that "alcohol poisons the blood, arrests the development, as well as hastens the decay of the red corpuscles." "Dr. Bocker noticed the alterations undergone by the blood of habitual alcohol drinkers *as yet in good health*, namely, a partial loss of power to become red by exposure to the air, in consequence of the loss of vitality in a portion of the blood discs. This loss of vitality manifests itself by the formation of black specks (oil) in the discs (an observation confirmed by Lallemand), and then by their conversion into round pale globules, which in all cases of disease (*i. e.*, diminished vitality), are found in excess in the blood." *

"This devitalized condition of the nutritive fluid," says Dr. Munroe, "is probably the first step to the deterioration of the tissues which it feeds."

"The eminent French analytical chemist, Lecanu, found as much as one hundred and

* *The Physiological Action of Alcohol.* By Henry Munroe, M. D., F. L. S.

The fact that Marcet has based his tables on six hundred and ninety-five cases actually applying to the hospital for treatment, has enabled him only

seventeen parts of fat in one thousand parts of a drunkard's blood, the highest estimate of the quantity in health being eight and one quarter parts, while the ordinary quantity is not more than two or three parts, so that the blood of the drunkard contains *forty times* in excess of the ordinary quantity." — *Henry Munroe.*

This is fatty degeneration of the blood, and lays the foundation of fatty degeneration of all the tissues of every organ of the body, which is the basis, according to Dr. T. K. Chambers, of "three quarters of the chronic illnesses which the medical man has to treat."

Can a blood thus vitiated, and bearing in its tide the very polluting and destroying substance itself, minister to and build up healthy organs? Must not all their functions become deranged, and thus a legion of diseases be caused?

"When spirituous liquors are taken into the stomach," says Dr. Aitken in his *Practice of Medicine*, "they tend to coagulate in the first place all albuminous articles of food or fluid with which they come in contact. *As an irritant* they stimulate the glandular secretions from the mucous membrane, and ultimately lead to *permanent congestion of the vessels* and to *thickening* of the *gastric tissues.*"

"Even diluted in the form of beer or wine," says Dr. Lankester, F. R. S., in his *School Manual of Health*, "it is found to act injuriously on the delicate membranes of the stomach and other digestive organs. When taken in larger quantities in any of the diluted forms, it acts most injuriously upon the stomach, liver, brain, heart, and other organs of the body."

The organs most affected by alcohol when taken into the stomach — the organs in which it is found most to accumulate — are, according to the eminent physiologists, Professors Lallemand and Perrin, the "liver and the substance of the brain. If in the blood it is represented by 1, in the brain it is 1.34, in the liver 1.48."

That intemperance is one of the conditions which tends to produce inflammations of the encephalon, meningitis, and cerebritis, all writers upon the subject agree. A frequent connection, as cause and effect, is established both by theory and observation with habitual intemperance and cases of apoplexy, paralysis, and epilepsy.

Besides these positive diseases, a premature exhaustion of nervous power, manifested in the decline of mental vigor and of nervo-muscular energy, is ranked by common consent among the consequences of habitual excess in the use of alcoholic liquors. That irritation and inflammation of the mucous membrane of the stomach, with a thickened, softened, and ulcerous condition is thus caused, is not only attested by hundreds of medical observers, but in the case of Alexis St. Martin, was clearly demonstrated in the living stomach by Dr. Beaumont.

He says: "The free use of ardent spirits, wine, beer, or any intoxicating liquor, when continued for some days, has invariably produced these morbid changes."

Dr. Peters, as quoted by Dr. Carpenter, has pointed out the effects upon the livers of seventy persons dead after the habitual use of alcoholic drinks. "In moderate drinkers the liver was generally found to be somewhat larger than usual, its texture softened, and its outer surface spotted with patches of fatty infiltration extending two or three lines into the parenchymatous substance, the rest of the viscus retaining its natural color and its edges their normal sharpness. In those who had been more addicted to the use of spirits, the liver was still larger, its edges were more obtuse, and the patches of fat on its surface were larger and more numerous. In old drunkards the liver was very large, weighing at least six or eight pounds, often from ten to twelve; the edges were very thick and much rounded, the parenchyma almost white with fat, soft, fragile, and the peritoneal covering could be torn off with ease.

"These observations indicated the various degrees of fatty degeneration, the result on the one hand of deficient functional activity of the gland, and on the other, indicative of an excess of fatty matter in the system." To these conditions are to be added the granular liver, or the "gin liver," as it is called.

Quite analogous to these degenerated conditions of the liver are the various degenerations of the kidneys, especially Bright's disease, or granular degeneration of the kidneys.

to show the proportion of sobers and drinkers among persons actually diseased, while it excludes all the sobers and drinkers who have escaped disease.

A table really showing the comparative liability of sobers and drinkers to disease, should be based upon equal numbers of average men in similar employments for a definite period of time. We should then know how many of each class escaped disease, and to what diseases those in each class were the most subject. In such a table we should have all the elements of the question.

And it will be noticed that Marcet does not frame his tables on the distinction of "drinkers and total abstainers," but upon the distinction of "drinkers to such a degree as plainly to do them injury, or to such a degree as ought to do them injury," and all others. Had his tables been calculated upon the basis of drinkers and total abstainers, it cannot be doubted that the liability of drinkers to the diseases mentioned would have been considerably increased. Dr. F. R. Lees, F. S. A., in his "Prize Essay on the Liquor Traffic," says: "Drink has the characteristic of predisposing to attacks of disease and preparing the way for the winged pestilence."

Let an epidemic appear in our midst, drunkards are its earliest victims, and its ravages are most desolating in those districts where drinking prevails.

Dr. Anderson, of Glasgow, states as the results of his experience in the treatment of two hundred and twenty-five patients in the epidemic of 1848–49: "I have found the use of alcoholic drinks to be the most powerful predisposing cause of malignant cholera with which I am acquainted. So strong is my opinion on this point, that were I one of the authorities,

Of this disease Dr. Christison states that "from three fourths to four fifths of the cases which he met with in Edinburgh were in persons who were habitual drunkards, or were in the constant habit of using ardent spirits several times in the course of the day."

"The experience of English hospitals is precisely similar," says Dr. Carpenter.

Gout and rheumatism are often found to be directly or indirectly caused by the use of alcoholics. Acute and chronic inflammation of the heart and arteries are not infrequently traceable to alcoholic intoxication, and "it cannot therefore be regarded as impossible," says Dr. Carpenter, "that those more chronic disorders of their walls, which give rise to aneurism, softening, fatty degeneration, and other structural changes, should be favored if not absolutely produced by the habitual presence of alcohol in the circulating current."

Besides these positive diseases, there is developed by the habitual use of alcoholic stimulants a marked *diminution* of *power* to *sustain injuries* by *disease* or *accident*, and a remarkable *liability* of those who indulge *to epidemic diseases.*

With the former of these positions the experience of every physician of any considerable practice is in harmony. How often are physicians disappointed at the results of diseases in cases of adults during the age when they ought to be in their prime. Many cases of fever and of many forms of inflammation, as well as almost every grade of accident and surgical operation, prove fatal unaccountably unless the habit of the subject as to the use of alcoholic drinks be taken into the account.

As to the liability of drinkers to disease as compared to sobers, W. Marcet, M. D., F. R. S., has an interesting chapter in his work on *Chronic Alcoholic Intoxication.* His tables are based upon six hundred and ninety-five cases of out-patients, carefully observed at the Westminster Hospital. Of the whole number, six hundred and ninety-five, two thirds, or four hundred and sixty-three, were caused by indulgence in alcohol, and were preventable by abstinence therefrom.

and had the power, I would placard every spirit shop in town with large bills containing the words 'CHOLERA SOLD HERE.' The comparative mortality in that epidemic he states was 91.2 per cent. of the drinkers to 19.2 per cent. of the sobers."

During the epidemic of 1832, it was noticed in Montreal, where 12,000 cases occurred, that "not a drunkard who was attacked has recovered, and almost all the other victims were moderate drinkers."

"In Warsaw it was found that ninety per cent. of those who died of the cholera had been in the habit of drinking ardent spirits to excess; and at Tiflis, in Russia, a town of 20,000 inhabitants, every drunkard is said to have been carried off by the disease."[1]

In preparing an address upon the entailments of alcohol, for the Michigan State Board of Health, in 1874, from which much of the material for this paper is taken, in order to ascertain as far as I could the current opinion and observations of various members of the medical profession, who are engaged in active practice, I prepared in circular form the following questions and sent them to about two hundred physicians in our own State, and about two hundred prominent physicians in other States: —

1st. What percentage of sickness in adults, within your observation, is directly due to alcohol?

2d. What percentage of deaths in adults, within your observation during the last year, is due directly to alcohol?

3d. Does alcohol, in your opinion, shorten the lives of its victims, and to what degree?

4th. What percentage of inherited disease and enfeebled constitution is traceable to alcoholism in parents or ancestors?

5th. What forms of disease, in your observation, are traceable immediately or remotely to alcohol?

6th. In which parent is alcoholism most likely to transmit disease or enfeebled constitution?

7th. In your opinion, based upon your observation, are the effects of alcoholism, immediate or remote, amenable to treatment?

8th. Does your observation show that there is danger of producing the state of alcoholism by the use of medicinal tinctures or elixirs?

To this circular I have received many replies, which may be consolidated as follows: —

To question No. 1 the replies varied from one per cent. to seventy-five per cent., with an average of eleven per cent.

To question No. 2 they varied from one per cent. to fifty per cent., with an average of thirteen and one half per cent.

To the third question the answers varied from five per cent. to fifty per cent., with an average of twenty-eight per cent.

To No. 4 the replies varied from five per cent. to very large and fifty per cent., averaging twenty-one per cent.

The replies to No. 5 indicate the following as diseases actually found in practice and traceable to alcohol: "Inflammatory diseases of the brain;"

[1] *A Prize Essay*, by Frederick Powell.

"apoplexy;" "many forms of paralysis;" "insanity;" "imbecility;" "diseases of the stomach, liver, and kidneys;" "all diseases dependent upon fatty degeneration;" "many skin diseases, gout, and rheumatism."

The replies to question No. 6 were nearly equally divided between "father" and "mother."

But, it may be asked, if alcohol causes such a percentage of deaths among adults, why does it not appear so in our vital statistics?

The answer is that in almost all the cases of death, more or less caused by alcohol, there is some disease or accident intervening which is credited with being the real cause; and in many other instances in which persons do actually die of delirium tremens, or even from the immediate effects of an overdose of alcohol, the physician will trump up some disease, to give to the family, of a more respectable sound, and this *respectable lie* gets into the vital statistics.

In the vital statistics of Michigan for 1870, out of 10,766 deaths there are fourteen attributed to "alcoholism." I have had the curiosity to look over the list of deaths of adults for that year which occurred in a single populous township, and I find that out of sixty-four deaths ten, or sixteen per cent., were more or less attributable to the use of alcoholic drinks to my personal knowledge. But in the report from which the vital statistics of that town were compiled, those deceased persons were all said to have died of respectable diseases. I have no doubt that the same or even a greater per cent. will obtain throughout the country.

It will be seen that the replies of my correspondents very generally confirm Marcet's conclusions, and the lists of diseases named by them, as especially liable to be caused by alcohol, are almost identical with those given by Dr. Wm. B. Carpenter.

Now bringing Carpenter's and Marcet's conclusions, and the observations of numerous physicians in actual practice, and the facts already stated in regard to the vital statistics of Michigan, to bear upon the census tables of the United States for 1870, and we have some very significant figures.

Marcet says: "Febrile disorders include the greatest proportion of drinkers compared to sobers irrespective of their employments, this proportion being one drinker to 1.08 sobers. . . . . This influence of the abuse of alcohol as a predisposing cause to febrile diseases probably results from its interfering with the healthy process of nutrition and lessening the general standard of health; a morbid poison exerting thereby the more readily its baneful action."

For the year ending June 1, 1870, there were in the United States 33,468 deaths from fevers, including typhus, enteric, yellow, intermittent, remittent, and typho-malarial, of which 18,102 were males, and 15,366 were females. The total deaths from all causes were 492,263, of which 260,673 were males, and 231,590 were females, or 1.12 males to one female.

Marcet says, "The proportion of drinkers is nearly as great in diseases of the lungs as in febrile diseases."

There were, during the census year, deaths —

From Pneumonia,	22,358 males, and 17,654 females.
From Bronchitis,	2,209 males, and 1,842 females.

Nearly all of the physicians who replied to the circular, assigned alcohol as a frequent cause of "inflammatory diseases of the brain," "apoplexy," and "many forms of paralysis;" and Dr. Carpenter says, "There can be no hesitation, therefore, in admitting the relation of cause and effect, in cases in which it is so obviously established by the sequence of the phenomena."

The census of 1870 reports deaths —

From Encephalitis,	7,579 males, 6,122 females.
From Meningitis,	1,843 males, 1,419 females.
From Apoplexy,	2,982 males, 2,244 females.
From Paralysis,	3,842 males, 3,659 females.
From Epilepsy,	778 males, 636 females.

The foregoing views of Drs. Carpenter, Peters, and Christison, on the influence of alcohol in causing disease of the liver and kidneys, received confirmation in the replies of the correspondents, and those views add great significance to the following statistics from the census. There were deaths —

Bright's Disease,	1,080 males, 642 females.
All other diseases of Kidneys,	1,822 males, 419 females.
Diseases of Liver,	3,111 males, 2,192 females.

There were attributed directly to alcohol, 1,161 deaths of males, and 249 of females.

In the vital statistics of Michigan for 1870, from known facts, in one township at least ten per cent. of the deaths were more or less directly due to alcohol; if the same proportion holds throughout the country, the appalling number of 49,000 deaths are more or less directly chargeable to alcohol every year.

I have purposely passed over, until now, two or three diseases or classes of disease, so that, being last spoken of, the mind might rest upon them the longer, for, although the diseases already named are exceedingly grave, yet these, affecting as they do the intellectual and the moral condition and development of the man, appear to me to challenge our more serious attention.

"There are," says Dr. Carpenter, "some individuals in whom a fit of positive madness, persisting for some time after the immediate effects of the stimulus have subsided, is brought on by every excess in drinking."

This he terms "delirium ebriosum." It is not intoxication, but a consequence of it; it is the *tonic* delirious excitement resulting from intoxication, while delirium tremens is the *atonic* excitement of a nervous system exhausted by long continued intoxication.

Dr. Carpenter, while discussing delirium tremens, says: "It is important to remark that a slighter form of this disease marked by tremors of the hands and feet, deficiency of nervous power, and occasional illusions, will sometimes appear as a consequence of habitual tippling, even without intoxication having been once produced." Marcet calls this a distinct disease, and gives it the name of "chronic alcoholism."

"The symptoms of the disease depend on a functional disturbance of the nervous system which may last for weeks, months, or years, even after the

habit of excessive drinking has been given up." It is a degenerated condition of the man in consequence of the more or less complete saturation of the system with alcohol ; a condition in which the will is weakened, while the baser appetites are strengthened ; a condition of the citadel that invites the attack of the enemy by having exhausted the resources for defense. In insanity, on the other hand, we have a condition of the man still further degenerated, — a citadel in the very confusion of capture and pillage, while in dementia and idiocy the citadel is dismantled and in ruins.

"Lord Shaftesbury, after having acted as commissioner of lunacy in England for twenty years, and as chairman of the commission for sixteen years, says, having made inquiries into the matter, the result is that *fully six tenths* of all the cases of insanity to be found in these realms arise from no other cause than from *the habits of intemperance in which the people have indulged*."

"The number of deranged people in a country corresponds very closely with the amount of strong drinks that are consumed. Till the introduction of fire-water among the American Indians, insanity was unknown. In Cairo, comparatively teetotal, there is one insane person to every 30,714 of the inhabitants. In Spain, comparatively sober, the consumption of alcohol being only one gallon per head per annum, there is one insane person in every 7,181. In Normandy, consuming two gallons of alcohol per head per annum, one in every 700. In Norway, consuming two gallons, one in 551. In England, consuming two and a half gallons, the proportion is one in every 430 of the inhabitants."[1]

In Michigan, where, in 1865, according to Commissioner Wells' report, before referred to, the sales of the retail liquor traffic amounted to a little more than $45 for every man, woman, and child in the State, the census of 1870 states that there are 829 insane persons in a population of 1,184,282, or one to every 1,428. In the United States the census gives one insane person to every 1,029. While in New York, where $56 per annum for each inhabitant were spent for alcoholic drinks, there is one insane person to a little less than 700.

I have no doubt that many other elements than the use of alcoholic drinks among the people, enter into the etiology of insanity ; but certainly these figures should arrest our attention, and if possible, statistics of this kind should be verified with the misleading elements eliminated.

In reply to the following questions sent in circular form to the insane asylums of this country, I have received the following statistics of 24,789 cases of insanity as related to intemperance : —

1st. In what percentage of the inmates of your asylum has insanity or epilepsy, in your opinion, been due to alcoholism in the individual?

2d. In what percentage of cases, in your opinion, is it due to hereditary degeneracy, taking its origin in alcoholism in the parents or ancestors?

3d. Is the former percentage, in your opinion, increasing?

4th. Is the latter percentage, in your opinion, increasing?

5th. From alcoholism in which parent, is hereditary degeneracy the stronger?

[1] Dr. Lees' *Prize Essay on the Liquor Traffic.*

6th. Does alcoholism, in your opinion, tend directly to shorten life?

7th. To what degree?

8th. Does it tend decidedly to deteriorate and exhaust the race?

9th. What other origins of the depraved appetite for drink do you recognize than alcoholism in the individual, or his parents or ancestors?

10th. Does alcoholism give origin to other forms of physical and mental degeneracy?

11th. What percentage of those persons in whom the diseased or depraved appetite takes its origin in alcoholism, either in the individual or his parents or ancestors, are, in your opinion, curable?

12th. Which class is the most amenable to treatment?

To question No. 1, I received various answers, giving the percentage of cases as from "6 to 20."

To question No. 2, I received one answer giving the percentage as "30 or more," and one other giving it as "20," while nearly all who replied at all said "No data."

To the 3d and 4th questions most of the replies were "yes," while some replied "don't know," "can't say," or "no data."

A few replied to the 5th question, "mother," and a few "father," while most said "Don't know," or "Can't say."

To the 6th question all said "yes."

And to the 7th the answers were from "Decidedly" to "25 per cent."

All said "yes" to the 8th, while from all the replies to the 9th question I gathered that "any physical degeneracy, and many unfavorable conditions, and many things which are assigned as causes of insanity, may develop the appetite for strong drink."

And nearly all the replies to the 10th agree in saying that "alcohol does give rise to various other forms of physical and mental degeneracy, such as deaf mutism, blindness, idiocy, viciousness, and low, depraved appetites."

From the statistics of the 24,789 cases of insanity, sent me by fourteen asylums, I have compiled the following: —

Of all the cases of both sexes, intemperance was assigned as the cause in 7 per cent.; of all the cases of both sexes, less 7,661 "unknown" or "unassigned," in 10 per cent.; of all the cases of both sexes, less 7,661 "unknown" and "unassigned," and 2,006 under 20 years of age, in 12 per cent.; of all the males (13,214) 13 per cent.; of all the males, less 4,092 "unknown" or "unassigned," 18 per cent.; and of all the males, less 4,092 "unknown" or "unassigned," and 1,085 under 20 years of age, 19½ per cent., while of all the females only 1½ per cent. were attributed directly to intemperance.

I have to remark of the superintendents of the sixty asylums for the insane to which I sent my circulars, that only fourteen of them replied at all, indicating, I think, that they take very little interest in the subject, or that the records of their asylums were barren of statistics, or probably both.

The replies and reports from these fourteen indicate that there is no great dependence to be placed upon their statistics of "alleged causes of insanity."

Under "intemperance" as a "cause," is included in these reports only those cases, who by personal indulgence in intoxicating drinks and beastly intoxication "known to all men," have brought upon themselves a degeneracy of the system that has had a sudden outbreak in insanity, following, perhaps, on the heels of a debauch; while there is no account taken of the degeneracy, whose outbreak may be to-day insanity, but whose origin was in the secret, moderate, but long-continued use of alcoholic stimulants, or in the drunkenness or other vice of parents or ancestors.

Of this Dr. C. H. Hughs, superintendent of the Missouri State Lunatic Asylum, says: "Few know how many alcohol directly or indirectly sends to our insane asylums. The tables of causes of insanity of these institutions do not even fully show this, for the reasons that many friends of the insane withhold the truth from the asylum record books, when they know the vice of liquor-drinking to be the real cause. In many instances, also, where alcohol is really to blame, the friends are not certain that the use of liquor has been the cause of the "business failures," and "perplexities," "domestic afflictions," "bereavements," and "infelicities," "ill health," and "nervous prostration," so often recorded as the immediate or direct causes of insanity, and they give the patient, for the sake of his friends and his character, the "benefit of the doubt." Only diligent inquiry on the part of asylum superintendents brings out the truth that liquor-drinking is the root of much evil that the world in general, with all its knowledge upon this subject, knows not of, — that it is at the bottom of much of the mischief done to the human system, terminating in insanity and accredited to other causes.

"The offspring of the inebriate — even to the third and fourth generations — suffer for the vices of their parents. They are either dipsomaniacs, epileptics, impotents, paralytics, idiots, imbeciles, possessed of inordinately vicious, criminal, or immoral instincts and propensities, or totally insane.

"Brain changes, begun through the instrumentality of alcohol in the parents, are thus developed and completed in their children, conceived and born after the formation of the habit of drinking. The seeds of mental or moral defect, or of physical disease, sown in the incipient drinker, may thus remain, comparatively speaking, dormant in him through his life, but find rich soil for rapid growth to baneful perfection in his offspring."

"Dr. Morel of France" — says Dr. Story, "connected for several years with Salpetriere Hospital, where there are more than one thousand insane persons, and afterwards for several years superintendent of Mareville Lunatic Asylum, equally large — states that there is always a hopeless number of paralytic and other insane persons in our hospitals whose disease is due to no other cause than the abuse of alcoholic liquors. In one thousand, upon whom I have made especial observation, not less than two hundred (20 per cent.) owed their mental disorder to no other cause."

"Dr. Behics, in making a report on the physical causes of insanity in France, says that of eight thousand and eight hundred male lunatics, and seven thousand and one hundred female lunatics, thirty-four per cent. of the

men and six per cent. of the women were made insane by intemperance." "And Motet reports among eight thousand seven hundred and ninety-seven cases of insane from physical causes, there were three thousand and forty-five drunkards." [1]

Dr. Carpenter quotes the report of Dr. Hutchinson, of 1,900 insane patients in seven years in the Glasgow Lunatic Asylum, in which within a small fraction of twenty per cent. are set down as caused by intemperance. "In one asylum in the east of London the per cent. is 41." And Dr. Macnish states that of two hundred and eighty-six lunatics at that time in the Richmond Hospital, Dublin, one half owed their madness to drinking.

There appears to be quite a discrepancy between the statistics, as given by Lord Shaftesbury, concerning the relation of insanity to alcohol, and those that we have gleaned from our own asylums, bearing upon the same subject, in this country.

The discrepancy will, I think, be seen to be more apparent than real, when several considerations shall have been noticed.

In the case of insane male adults no effort has been made, or at least none has been reported, to ascertain whether they were children begotten while either parent or both were the subjects of chronic alcoholism or of intoxication. No statistics of this kind are reported either of the insane under twenty years of age. The fair presumption of this class who have become insane before many of the causes that tend to produce insanity in older persons have come to bear deleteriously upon them, is that many or most of them have some inherited degeneracy that makes them especially susceptible to any exciting causes of insanity.

Had we the statistics to show in how many of these cases the inherited degeneracy took its origin in alcoholism in the parents or ancestors, the number assigned to that cause would, no doubt, be largely increased. This is made probable by the fact that Dr. S. G. Howe, on careful inquiry into the parentage of three hundred cases of idiocy, found that one hundred and forty-five of them were the children of acknowledged drunken parents.

Again, only one and a half per cent. of the female insane are reported as owing their insanity to intemperance. This fact, while it goes far to establish the intimate relation of causation between alcohol and insanity (for but very few, comparatively, of our American women drink habitually), would, no doubt, be greatly modified if the truth could be ascertained in respect to the hereditament of all these insane women, for, if it is established as a law of hereditament, as many writers believe, and as is very ably argued by Dr. John Stockton Hough, that daughters resemble their fathers, while sons resemble their mothers, it follows that in a given number of insane or otherwise degenerated females, we ought to find the seeds of *their* degeneracy planted in the preceding generation of males; while in the cases of insane or otherwise degenerate males, we ought to trace the degeneracy back through their mothers to the second generation of males; so that the present generation of insane and alcoholized males will have a full representation in the next generation of insane females.

[1] *Alcohol and its Effects.* Dr. Chas. A. Story.

On this subject Dr. Andrew McFarland, of Oak Lawn Retreat, writes me as follows: —

"Some instances occurring to me are very interesting. I know one old New England family line in which insanity has existed now for the fifth generation, not less than one hundred and fifty individuals having been victims of that inheritance.

"When Dr. Bell of the McLane Asylum, and myself, were in charge of neighboring institutions, we could always count among our patients eight or ten out of this original family stock; and yet it produced persons of eminent ability, from President of the United States downward.

"In such notable instances there will be a great infusion of cases of dipsomaniacs, besides hard drinkers not classed as diseased.

"I thus believe — though I cannot show facts absolutely to prove — that these predispositions often date from some vigorously constituted individual, who engrafted on the stock habits of inebriety. To show how and when vicious infusions get into an originally pure stock, — as, for instance, in the case of the great and good Jonathan Edwards, some of whose descendants had a distinction in profligacy as great as his own for the opposite, would be interesting and profitable if we had the facts. But I believe the greatest disasters to blood come in on the female side; for it seems next to impossible for a dipsomaniac mother to have a progeny not very largely vitiated. It is only to cite common observation how liquor-drinking, opium-eating, and sexual excesses and looseness, cling as habits to certain families; a fact not all explainable on a theory of mutual example. If we could trace back, we should, I imagine, find the exact generation where the ruling vice came in, as we could where the royal house of Austria got its distinguishing lip, or the Bourbon his nose.

"It is your stout old hero, who goes to bed every night with liquor enough under his belt to fuddle half a dozen ordinary men, and yet lives out his threescore years and ten, that will be found at the fountain head of the stock that pours into the world, generation after generation, such a crop of lunatics, epileptics, eccentrics, and inebriates as we often see. The impunity with which one so constituted will violate all physical law gets its set-off in a succeeding generation, when the great harvest begins.

"That 'the iniquities of the fathers are visited upon the children; that the fathers have eaten sour grapes and the children's teeth are set on edge,' are truths that no Scripture is needed to teach. In other words, he who sins through physical excess does not do half the harm to himself that he does to the inheritors of his blood. The penalty *has got to be paid*, as sure as the obligation of Faust to the Evil One."

Is not the very fact that so many of the inmates of our asylums are recorded "unassigned" or "unknown," of itself suggestive that there may be in all that number a degeneracy of stock, though difficult to trace, yet surely the growth of seeds sown in preceding generations?

If these things could be fairly traced out, and alcohol had due credit for causing "business failures," "domestic trouble," "bereavements," "ill health," and "nervous prostration," which appear in the reports of asylums

as the causes of so many cases of insanity, who can doubt that the percentage of cases justly assignable to alcohol would be nearly or quite equal to that given by Lord Shaftesbury for England?

Applying these conclusions to the vital statistics of the United States, we have the following results.

The census reports as the whole number of insane persons in the States and Territories, 37,432.

In the statistics of "causes," in 24,789 cases of insanity, received from the fourteen asylums replying to the circular, seven per cent. of all the cases were said to be caused by alcohol; and omitting the "unknown," or "unassigned," ten per cent. were said to be thus caused. Even these low figures would give 2,620, or 3,743 cases of insanity in the year 1870, caused by alcohol. If we assume twenty-five per cent., which, from all the considerations I have adduced, appears entirely below the truth, we have 9,358 of these cases attributable to the effects of alcohol. But if, induced by all the foregoing considerations, we adopt the percentage for this country that Lord Shaftesbury has adopted for England, we have in the United States and Territories the fearful number of 22,458 cases of insanity more or less directly caused by alcohol. But "it is held by many persons conversant with the special subject, that the returns of the census in respect to the blind and the deaf and dumb, and also, in a higher degree, to the insane and the idiotic, are always, and necessarily, considerably below the fact. F. B. Sanborn, Esq., of Massachusetts, late Secretary of the Board of Charities for that commonwealth, has advanced the opinion that the numbers reported in the census, be it State or National, rarely embrace more than sixty or seventy per cent. of their respective classes."[1]

Under such considerations our several numbers of cases of insanity caused by alcohol must be correspondingly increased, and we have the numbers as given by the several percentages, 7, 10, 25, and 60, as follows: 4,366, 6,238, 15,596, and 37,430.

From insanity produced by intemperance in the individual the road is often short and quick to dementia, imbecility, idiocy; and more especially is this true of insanity occurring as an outburst of a degeneracy whose origin was in alcoholism of parents or ancestors?

The degeneracy by no means stops with the man himself. By a law of nature, running through the animal as well as vegetable kingdoms, "like begets like;" "they shall bring forth seed after their kind." "Traits of character, dispositions, aspirations, talents, propensities, passions, depraved conditions, and diseases, may be inherited as well as form, looks, and complexion."

In accordance with this law, drunkenness in the parents has a special tendency to produce *mental debility*, *low and depraved appetites*, *weakness of will*, *loss of moral sense*, *vice and crime*, *insanity and idiocy* in the offspring.

"Looking to the decided tendency to hereditary predisposition in the ordinary forms of insanity," says Dr. Carpenter; "looking also to the fact that any perverted or imperfect condition of the nutritive functions established in

[1] *Census Report of 1870.*

the parent, are also liable to manifest themselves in the offspring (as shown in the transmission of the gouty and tubercular diathesis), we should expect to find that the offspring of habitual drunkards would share with those of lunatics in the predisposition to insanity, and that they would moreover be especially prone to intemperate habits."

That "one drunkard begets another," as Plutarch says, may be proven by common observation and by many recorded opinions and observations. Dr. W. A. F. Brown, the resident physician of Crichton Lunatic Asylum at Dumfries, makes the following statement: "The drunkard not only injures and enfeebles his own nervous system, but entails mental disease upon his family. His daughters are nervous and hysterical; his sons are weak, wayward, eccentric, and sink insane under the pressure of excitement of some unforeseen exigency, or of the ordinary cares of duty."

Dr. S. G. Howe, of Boston, in a report to the Massachusetts Legislature, says: "The habits of the parents of three hundred idiots were learned, and one hundred and forty-five, or nearly one half, are reported as known to be habitual drunkards. Such parents, it is affirmed, give a weak and lax constitution to their children, who are consequently deficient in bodily and vital energy, and predisposed by their very organization to have cravings for alcoholic stimulants. Having a lower vitality they feel the need of some stimulation. If they pursue the course of their fathers, which they have more temptation to follow and less power to avoid than the children of the temperate, they add to their hereditary weakness and increase the tendency to idiocy in their constitution, and this they leave to their children after them." Dr. Howe, in a letter dated February 20, 1874, confirms his opinion above given, by his subsequent observations.

"There is," says Dr. Carpenter, "a prevalent impression that idiocy is particularly liable to occur in the offspring when the conception has taken place, when one or both of the parents were in a state of intoxication." He quotes a striking example: "Both the parents were healthy and intelligent, and one, at least, habitually sober; but both were partially intoxicated at the time of the intercourse, and the offspring was completely idiotic." "There is," he says, "every reason to believe that the monomania of inebriety not only acts upon and renders more deleterious whatever latent taint may exist, but vitiates and impairs the sources of health for generations."

There has been sent me by one of my correspondents two sad illustrations of this terrible inheritance: "Five children were born in one family in Yates County, New York, all of whom were idiots, and two children idiots in Steuben County, New York, whose parents acknowledged that they were intoxicated when the conceptions took place."

Dr. Charles A. Leas, of Baltimore, sends me the following: "A boy in New York was born drunk: *i. e.*, from his birth he had an irregular, unsteady muscular action. The boy was in after years arrested for being drunk in the streets, and in the judicial examination it was proven that he had been so from his birth, and had inherited it from his father, who was a most terrible and habitual drunkard. In short it was shown and testified to by his mother that he had been born drunk and remained so."

I have myself frequently seen a girl upon the streets, now nearly or quite eighteen years old, whose movements are, and have been from her birth, almost precisely those of a man so drunk that he can with difficulty reel along; and her countenance bears the idiotic expression of that condition. Her father, who has since died of delirium tremens, is believed to have been beastly drunk when she was begotten.

Dr. Charles A. Story relates a case of "the first of seven children that was a complete idiot. Both parents were beastly drunk at the time of this child's conception. They quit drinking, and the other six children have inherited about average intellects."

He relates another case in which "the first child has average common sense; the second is very much demented; and the third is a slobbering, drivelling fool. The explanation is easy. After marriage the parents began drinking, and in six years had become perfect sots."

But it is not alone in the condition of actual intoxication that such fearful conditions are entailed upon the offspring. But we have, alas, too many illustrative cases among the moderate but regular drinkers of the "best liquors."

Sometimes children who have appeared to be fairly endowed in early childhood surprise their parents and friends, at or near the age of puberty, by the sudden outcropping of their inherited feebleness and imbecility.

"A young man at the age of nineteen years was taken to the insane asylum at Mareville for mental derangement caused by excess in alcoholic drinking. As the inheritor of a good fortune, he received every attention and care in his early life, but they produced no effect on a perverse and obstinate nature, whose instincts were of the most cruel kind. When but three years old he was the terror of all the children in the neighborhood, whom he subjected to incredible tortures in the absence of older persons who would have restrained him. His chief pleasures of boyhood were in destroying and torturing animals. This young man had for his father a person who moved in educated society and filled important offices, but who was for a long time intemperate, concealing, however, the fact from the public eye. He had five children, only one of whom survived infancy, and he was the unfortunate being now described. Edward, as he was called by Dr. Morel, evinced in his tender years a great fondness for drawing and reading, and after a time was placed at college; but his teachers soon perceived that all their efforts were in vain, and that this boy, both in body and mind, was afflicted with an arrest of growth; his head was microcephalous and his intellect limited. On his return home he went rapidly through successive stages of degeneration by continual debauchery, until, fortunately, he was placed under restraint in an asylum. This young man labored under the double curse, first, of inherited predisposition, and secondly, of the example given to him by his father's excesses." [1]

"Morel exhibits a picture of progressive degeneration of alcoholic origin, and its continuance in a family until it ended in the extinction of the latter,

[1] A case related by Dr. Morel as quoted by Dr. John Bell in his report to the American Medical Association in 1869.

at the fourth generation. In the first generation there was immorality, excess in alcoholics, moral debasements. In the second, hereditary drunkenness, maniacal attacks, general paralysis. In the third generation, sobriety, hypochondriac tendencies, lupomania, systematic belief in persecutions, homicidal tendencies. In the fourth, limited intelligence, a first attack of mania at sixteen years of age, stupidity, transition to idiocy complete and incurable."

The following cases were sent me by Dr. William B. Hazard, medical superintendent of St. Louis County Lunatic Asylum, in reply to circular: —

"Mr. N——. No alcoholism in ancestors so far as known; a very hard drinker in his earlier manhood. His first three children, boys, were idiots, — idiocy almost complete. Mr. N—— now reformed. His next son was bright but dissipated, — had to flee the country for forgery. Two daughters and one son followed, all of whom were excellent people."

"Two gentlemen named S——, now in middle life, both very hard drinkers. One has been in asylum many times with *mania a potu;* the other given to sexual excesses, adultery, etc. Their mother was a bastard and addicted to drink. One daughter of the first lewd, the other children not yet adult."

Dr. H. F. Lyster, of Detroit, kindly sent me the following: —

"The father lived to be forty-eight. He was of healthy stock and fine physique, had an excellent mind, was high bred, and educated to a profession. He had been brought up a moderate drinker, and during the last fifteen years of his life had been a very hard drinker, and the last seven years of his life an habitual drunkard, and mentally and physically disabled by alcoholic stimulants. It was during these fifteen years that most of the children were born. The mother lived to be eighty-seven, and has had thirteen children, and much care and work until within twenty years of her decease. She possessed a strong, healthy mental and physical constitution, much superior in both to the majority of people of the best class. Her mental and physical superiority existed until death. She was a total abstainer.

"Of the thirteen children, five died in infancy or early childhood of causes unknown to the writer, and were among the earlier children. Of those reaching adult life, one son died from accident at twenty-two, healthy bodily and mentally, and not intemperate; one daughter of heart disease at eighteen, mentally bright; and one son died of softening of the brain at forty-five, after a three years' illness. One daughter has had chorea for years of an aggravated character, wholly unfitting her for society and rendering connected conversation impossible. Her age is sixty-two. One son shows symptoms of approaching mental debility, at fifty-nine. One daughter nervous and near-sighted at fifty-six. One son has had partial paralysis and softening of brain at fifty-two. One son, a confirmed drunkard, now forty-six. One daughter nervous, eccentric, and very near-sighted at forty-four. All were near-sighted.

"The men were all, with the exception of the one who died at twenty-two, and the one now a confirmed drunkard, moderate drinkers. Previous

to accidental death of one and the premature decay of the others, all were men of superior ability, education, and attainments, and were of excellent physique."

Case II. "Mother, English, a healthy, hard-working woman of fifty, of low mental organization and small head; had three sons, one, the oldest, almost '*non compos mentis*,' aged about thirty, has epilepsy, no education; one of medium intelligence, but not bright, aged twenty-eight; and one of very low degree of intelligence, no education, aged twenty-four years. The father died from apoplexy, — a man of good physique, but had been a hard drinker for years."

Applying these facts and considerations to the census tables, and we have the following figures.

The whole number of idiotic persons reported by the census tables in the United States and Territories is 24,527, of which, on the basis of Dr. Howe's statistics 11,953 are caused by alcohol, or are the degenerate offspring of drunkards.

But correcting this table in the census in accordance with the views of F. B. Sanborn, Esq., and we have 40,880 idiotics, and 18,270 caused more or less directly from alcohol.

Several of the superintendents of insane asylums have stated, in answer to the fourth question in the circular sent them, that the proportion of insane persons, whose insanity appears to take its origin in a hereditary degeneracy from alcoholism in the parents or ancestors, is increasing.

This may be only an apparent increase owing to the more careful scrutiny with which this very question is investigated, or it may be a real increase from the greater age of the nation, and the longer indulgence in alcoholic drinks by certain families, in whom the taint of blood becomes stronger in each succeeding generation. Indeed, is not the greater proportion of insane persons in the older States, as New York and Massachusetts, mainly to be explained in this way?

As the Western States grow older, will not such examples of entailed degeneracy in families or clans, as related above by Dr. McFarland, become common unless the very source of the degeneracy be dried up?

If this reasoning be true, it is not surprising that in England and Scotland, where for several centuries almost all the people have been habitual drinkers, and where the taint of blood, though very small three or four centuries ago, has been constantly deepening from generation to generation, there should be very many families giving a similar or even a darker history in respect to insanity, than the New England family above mentioned, while other families may have long ago, from the same cause, become extinct?

In this way it is easily to be believed that the proportion of insanity traceable to such degeneracy might be indefinitely increased.

Is not the very fact that after several generations such degenerate families do become exhausted — the very salvation of the race?

Says Dr. S. G. Howe, in answer to a question in the circular: "Families are exhausted and become extinct, but not the race."

Thus the fearful judgment pronounced by God, "I will visit the iniquities

of the fathers upon the children to the third and fourth generation," while it contains a condemnation and punishment for the sins of individuals and families, inherent in the very laws of physiology; contains, also, a merciful provision for the perpetuity of the race, in that it hints that the tainted blood and degenerate stock shall, after so many generations, become extinct and give place to others, and the accompanying benediction pronounced upon the righteous appears to warrant this interpretation.

The foregoing considerations would seem abundantly to justify the replies of the various correspondents to the question whether alcohol tended to shorten the lives of those who used it. But for a more definite and reliable answer to this question we are indebted largely to insurance companies and their actuaries.

"Thus the policies issued by four of the principal offices (in England) amounted to 6,153 and the number of deaths during a given period to 117, being an average of almost twenty deaths to 1,000 members. During the same period the Temperance Provident Institution issued 1,596 policies and had only twelve deaths, or 7½ per thousand, being nearly one-half less than the deaths in the most healthy non-teetotal offices, as follows: —

1st office issued	838 policies;	had 11 deaths;	13 to 1000.
2d office issued	1,901 policies;	had 27 deaths;	14 to 1000.
3d office issued	944 policies;	had 14 deaths;	15 to 1000.
4th office issued	2,470 policies;	had 65 deaths;	26 to 1000.
T. P. Inst. issued	1,596 policies;	had 12 deaths;	7½ to 1000.

"In the government returns of the sickness and mortality of the European troops forming the Madras army for the year 1849, in which the men are classed as *total abstainers*, *temperate*, and *intemperate*, the results are highly favorable to the total abstaining soldiers. Of 450 *total abstaining* soldiers the rate per cent.[1] of admission into hospital for treatment of various diseases was 130.888. The rate per cent.[1] of deaths was 1.111. Of 4,318 *temperate* soldiers the rate per cent. of admission into hospital for treatment of various diseases was 141.593. The rate per cent. of deaths was 2.315. Of 942 *intemperate* soldiers the rate per cent.[1] of admission into hospital for treatment of various diseases was 214.861. The rate per cent. of deaths was 4.458. 'From these it will be seen,' says Dr. Carpenter, 'that whilst the number of deaths among 450 *total abstainers* during the year was 5, or 11.1 per thousand, the number among 4,318 *temperate* men was 100, or 23.1 per 1,000, being rather more than *double* the previous proportion. As to the *intemperate* the increase is frightful, for among 942 such men the number of deaths was not less than 42, or in the *quadruple* ratio of 44.5 per 1,000."[2]

Dr. Willard Parker of New York city, President of the New York State Inebriate Asylum, in his "Statistics of Inebriety," gives the results of the distinguished English actuary, Mr. Neison, who took a prominent part in investigating the influence of inebriety upon the risks of life insurance companies, both in this country and abroad, as follows: —

[1] This refers to the number of cases of sickness, etc., annually in one hundred men.

[2] *Bacchus Dethroned.* A Prize Essay. By Frederick Powell.

18

1st. When in a given number of risks *ten temperate* persons die between the ages of fifteen and twenty inclusive, *eighteen intemperate* persons die.

2d. When in a given number of risks *ten temperate* persons die between the ages of twenty-one and thirty inclusive, *fifty-one intemperate* persons die, or the risk on an inebriate is more than 500 *per cent. greater* than on a temperate person.

3d. When in a given number of risks *ten temperate* persons die between the ages of thirty-one and forty inclusive, about *forty intemperate* persons die, or the risk is *increased* 400 *per cent.*

A person's chances of living at the various ages are given as follows: —

At twenty, the expectancy of a temperate person is 44.2 years, of an intemperate person 15.6. At thirty, the expectancy of a temperate person is 36.5 years, of an intemperate person 13.8. At forty, the expectancy of a temperate person is 28.8 years, of an intemperate person 11.6.

These statistics and tables give an emphatic answer, *that alcohol does shorten the lives of its consumers*, and fully justifies the average per cent. (28) given in the answers of physicians to the third question in the circular.

On account of the great length to which this paper has already come, I shall pass over the *relation of alcohol to accidents and the accidental destruction* of human life, with simply an appeal to the common observation of men to justify my charge that more than one half of all the accidents occurring in the year, by sea and land, are chargeable more or less directly to alcohol.

In respect to *its relation to vice, — the social vice, — and the disease that is sown by and feeds upon it*, almost every physician can bear testimony, that, in a large majority of cases suffering from venereal diseases, the testimony of the victim is, "I drank, and when my passions were inflamed, my moral sense blunted, my conscience overwhelmed, and my will dethroned, I was led to the house of her 'whose steps take hold on hell.'"

For brothels to flourish, they must either keep liquors themselves or be located close to a drinking saloon.

Not one in ten of these places could be kept up for a year, were it not that the baser passions of men are inflamed and unbridled by alcohol in or near them.

I have no heart to describe the woeful inheritance of diseases in body, mind, and soul, of the children of parents in whom the poison of syphilis is mingled with that of alcohol.

I cannot refrain from referring to some statistics showing the relation of the habitual or excessive use of alcoholic drinks to crime. Says Dr. Elisha Harris, "it is a fearful fact that the brain, as the organ of the soul and the instrument and magnet of the mind, is liable to be cast into utter disorder, and to have all its resources of fancy, of thought, of will, of self-consciousness, of sentiment and affection, and of tenderest and gentlest responses of the human instincts, *confused*, *perverted* and turned into diabolical fury or satanic wickedness of action and device."

"Mr. Simmons, governor of the Canterbury Prison, thus writes: 'The number of prisoners who have been committed to the prison with which I

have been connected during the last fifteen years amounts to 22,000; among whom *I have never met* with one being a teetotaler.

"From the experience I have had I calculate that from 90 to 92 per cent. of all crimes are committed through taking intoxicating drink, in a direct or indirect way.'"[1]

The Rev. W. Caine, M. A., late chaplain of the Salford Hundred Jail says "of 296 female convicts, 165 confessed that they were drunkards; of 704 males, 480 admitted that they were drunkards."

The chaplain of the Massachusetts State's Prison testifies "that nineteen out of every twenty, confined within these prison walls, were there for crimes committed through the agency of liquor."

Almost all our judges of Police Courts will coincide with the English Judge Coleridge, who says: "There is scarcely a crime that comes before me that is not, directly or indirectly, caused by strong drink," and with Judge Wightman, when he says, "I find in every calendar that comes before me one unfailing source, directly or indirectly, of most of the crimes that are committed — *intemperance*."

Abundant statistics are at hand to show that the amount of crime varies in close ratio with the amount of liquors drunk by a people. To only two such facts will I now allude.[1]

"In England and Wales during the four years succeeding 1820, the consumption of spirits amounted to 27,000,000 gallons, and the number of criminals committed for trial was 61,262. During the eight years from 1824 to 1832 the committals had increased fifty per cent. and the consumption of spirits seventy-seven per cent."

"In Scotland," says Dr. Nott, "in 1823, the whole consumption of intoxicating liquors amounted to 2,300,000 gallons; in 1837 to 6,776,715 gallons. In the meantime crime increased 400 per cent., fever 1,600 per cent., deaths 300 per cent., and the chances of human life diminished 44 per cent."

"In 1840, owing to the Great Temperance Agitation conducted by Father Mathew, the public houses within the police bounds of Dublin had lessened by 237, and the prisoners in the Richmond Bridewell, which had numbered 136 on the first of September, 1839, were reduced to 23 on the sixth of November, 1840."

"Lord Morpeth, when Secretary for Ireland, gave the following statistics in a speech on the condition of Ireland, delivered after a public dinner in Dublin. Of cases of murder, assault with attempt to murder, outrageous offense against the person, aggravated assault, cutting and maiming, there were in 1837, 12,096; 1838, 11,058; 1839, 1,097; 1840, 173.

"Of persons charged with murder within the police bounds of Dublin, in 1838, 14; in 1839, 4; in 1840, 2; in 1841, 1.

"The Temperance Agitation commenced in 1838, and by the tenth of October Father Mathew had inscribed on his roll of Teetotalers 2,500,000 names, and the consumption of spirits had decreased for the year 1840 by 5,000,000 gallons."

In the annual report of the Inspectors of the State Prison of Michigan, for 1873, I find that of the 655 prisoners remaining in the prison at the

[1] Powell's Prize Essay.

close of the year, 305, or 46.57 per cent. were intemperate; 143, or 21.83 per cent. were moderate drinkers; 207 or 31.60 per cent. are said to be "temperate."

"More than half of all the convicts in the State prisons and penitentiaries voluntarily confess the fact that they were intemperate and frequently drunk previous to the crimes for which they are imprisoned, and that such intemperance had an essential influence in preparing them for the acts of crime. About eighty-two per cent. of the convicts in the United States privately confess their frequent indulgence in intoxicating drinks. The Superintendent of the Detroit House of Correction found that only eighteen per cent. of the convicts in fifteen State prisons, and a large number of county jails, even claimed to be temperate. This may be taken as a fair statement of percentages of the temperate and intemperate in the prisons and jails of the United States and Great Britain.

"After two years of careful inquiry into the history and condition of the criminal population of the State, we find that the conclusion is inevitable that, taken in all its relations, alcoholic drinks may justly be charged with far more than half of the crimes that are brought to conviction in the State of New York, and that fully eighty-five per cent. of all convicts give evidence of having in some large degree been prepared or enticed to do criminal acts because of the physical and distracting effects produced upon the human organism by alcohol, and as they indulged in the use of alcoholic drinks." [1]

"In an article prepared by A. S. Fisk, A. M., entitled 'The Relations of Education to Crime in New England, and the Facilities for Education in her Penal Institutions,' we find the following: 'The fourth fact is that from eighty to ninety per cent. of our criminals connect their courses of crime with intemperance.'" [2]

Let us now briefly consider some of the economic relations of this subject.

What do 49,000 *deaths caused by alcohol actually cost the nation?*

The average cost of burial cannot be less than ten dollars each, giving the sum of $490,000. These 49,000 persons should have had, according to a table of "Working Years" (calculated from Life Tables, by Dr. Edward Jarvis, and published in the Fifth Annual Report of the Massachusetts State Board of Health), 37.46 years each of effective life.

From the best data we have been able to collect, we have been led to conclude that alcohol shortened the lives of those who use it habitually or excessively, twenty-eight per cent. As this percentage pertains to the *whole* life, including the developing and the effective periods, it follows that these 49,000 persons have each lost to the nation twenty-eight per cent. of 57.46 years, or 16.08 years of effective life, giving a total of 784,000 years.

These figures are much below the actual loss, according to the expectancies of intemperate persons given above; for, according to those expectancies, the average loss of effective life by intemperate persons is twenty-three years, within a small fraction. On this basis, the annual loss of the nation of effective life by those who die from the effects of alcohol, is 1,127,000 years.

[1] Dr. Elisha Harris on the *Relations of Drunkenness to Crime.*

[2] *Our Wasted Resources*, pp. 143, 144.

If each effective year of life be valued at $150, the nation loses on the first calculation $117,600,000, and on the second calculation $169,050,000.

English actuaries, from careful observation and calculations, estimate that for every death there are two persons constantly sick.

We may, therefore, calculate that for these 49,000 deaths from alcohol there are 98,000 constantly sick from the same cause. Thus, in a single year, 98,000 years of effective life are lost to the State, which, valued at $150 per year, give a loss of $14,700,000.

The cost of this sickness, at the very lowest estimate, cannot be less than $150 a year, or a total of 14,700,000.

What do the insane caused by alcohol actually cost the nation each year?

We have already seen that, in a very moderate estimate, twenty-five per cent. of the insane are made so by alcohol. Thus, 9,358 of the 37,432 insane persons enumerated in the census tables are thus caused. These represent in each year a loss of effective life of 9,358 years, which, valued at $150 per year, give a loss to the nation of $1,403,700.

The average cost of maintaining and caring for these insane persons cannot be less than four dollars per week each (the average cost in three of the State asylums of Massachusetts). This will give a total loss to the State for their support and care of $1,965,180. But, according to a table constructed by Mr. John Le Copeland, and the English Life Tables (quoted by Dr. Edward Jarvis, page 383 of the Fifth Annual Report of the Massachusetts State Board of Health), the average loss of effective life, by their premature deaths, of insane males and females is 6.3 years each. But, as those made insane by alcohol are generally made so at or before forty years of age, the loss of effective life for the insane should be based upon the loss in the three first decades, namely, from twenty to forty inclusive, which is an average for each person, male and female, of 10.5 years. This gives a total loss of effective life for the 9,358 insane, made so by alcohol, of 98,259 years, — which, at a value of $150 per year, gives a loss to the nation of $14,738,850.

If, now, we adopt Lord Shaftesbury's estimate of the percentage of insanity caused by alcohol, these figures should all be increased by 140 per cent., and we should have for loss of effective life, at 10.5 years for each insane person, made so by alcohol, 235,821 years, with an estimated value of $35,-373,150. The annual cost of supporting the insane from alcohol, on that percentage, would be $4,716,432.

What does the nation lose by her idiots, made so by alcohol?

The whole number of idiotic persons reported in the census tables is 24,527, of which, on the basis of Dr. Howe's statistics, 11,953 are caused by alcohol, or are the degenerate offspring of drunkards. If we correct these tables, according to the views of F. B. Sanborn, Esq., quoted above, we have as the probable whole number of idiotic persons, 35,040, and the number traceable to alcohol or its effects 17,080. The average cost for the care and support of these unfortunates, must be at least $150 per year, making a loss to the nation of $2,562,000.

Allowing that one half of these persons, if they were not imbecile, would die before maturity, and thus would have no effective life, there remains for

the others a loss to the nation of all the effective life to which they should have been entitled, or 37.46 years each, giving a total loss of 319,908 years, with an estimated value of $47,986,200.

As crime may properly be considered, in one sense, but a form or symptom of disease, and as it has been, I think, fairly shown that at least three fourths of all the crimes committed in this nation may be traced more or less directly to the influence of alcohol — in our estimate of the losses of the nation resulting from it, the cost of the crimes committed annually in the country, and traceable to the influence of alcohol, should include their damage in direct destruction of property, the loss of effective life by murder, and the punishment of criminals, and the cost of detecting, arresting, convicting, and punishing the criminals. Greatly to my regret I have at hand no reliable data from which an approximate estimate of those immense losses to the nation may be computed. I think it is plain, however, that they must be counted by hundreds of millions.

The losses, too, from accidents by sea and land annually caused by alcohol, including loss of property destroyed, and effective life lost by premature deaths of those killed, would foot up millions. If pauperism is not a disease, it certainly has a very close relation to the diseases and diseased conditions of the system caused by alcohol, and the losses of the nation for pauperism thus caused, should also be included in this estimate. We have, however, no reliable data from which we are able to express these losses in figures. No doubt, however, the annual losses from crime, accidents, and pauperism, attributable to alcohol, would equal or exceed $1,000,000,000.

I have given below a table showing the estimated losses of the nation from the effects of alcohol upon the public health, except under the last named heads, showing clearly, I think, that the losses of this nation, annually, from these causes, must equal or exceed $2,000,000,000.

Annual Losses of the Nation from the Effect of Alcohol upon the Public Health.	No. of Persons. Lowest Estimate.	No. of Persons. Highest Estimate.	No. of Years. Lowest Estimate.	No. of years. Highest Estimate.	Value for each.	Total Value. Lowest Estimate.	Total Value. Highest Estimate.
Funeral expenses of persons dying more or less directly from alcohol	49,000				$10.00 each.	$490,000	$490,000
Loss of effective life on those persons dead from alcohol . . .	49,000		784,000	1,127,700	$150.00 per year.	117,600,000	169,050,000
Loss of effective life from sickness caused by alcohol	98,000		98,000	98,000	150.00	14,700,000	14,700,000
Cost of this sickness	98,000				150.00 per year.	14,700,000	14,700,000
Loss of effective life by the insane from effects of alcohol on account of premature death . . .	9,358	22,459	98,259	235,000	150.00 per year.	14,738,850	35,373,150
Loss of effective life, one year, for each insane person so cured . .	9,358	22,459	9,358	22,459	150.00 per year.	1,403,700	3,368,880
Cost of support of the insane, made so by alcohol	9,358	22,459			4.00 per week	1,946,464	4,671,472
Cost of supporting the idiots caused by alcohol	11,953	17,080			150.00 per year.	1,722,950	2,562,000
Loss of effective life of one half the idiots thus caused	11,953	17,080	223,879	319,908	150.00 per year.	33,581,850	47,986,200
Totals	–	–	–	–	–	$200,883,814	$292,901,702
Cost of alcoholic liquors annually consumed[1]	–	–	–	–	–	$735,720,048	$1,483,491,865

[1] The lowest estimate of the cost of liquor is taken from *Our Wasted Resources*, by Dr. Hargreaves, p. 48 and the highest is from Commissioner Wells' Report for 1867

I shall close this paper with a few brief propositions, which I should be glad to have freely discussed by this Association.

If any subject demands the immediate, careful, earnest, and practical consideration of every branch of the government, general, state, and municipal, followed by wise and efficient legislation, this does.

Drunkenness is one of the greatest injuries to the State, and as such should be punished as a crime.

Tippling shops, bars, and drinking saloons give origin to, and promote, this evil, and, as enemies of the State, ought to be absolutely prohibited.

While it is right, proper, and wise, for the General Government to lay tax upon the *manufacture* of alcoholics, both for revenue and for restriction, it is not wise, just, or expedient for it to lay a tax upon the retail sales of these liquors; for, however it may be, regarded in the abstract, *men do count paying a tax to the General Government for selling intoxicating drinks*, *a sort of justification for*, *and a protection in*, *their business.* This tax has been for the last ten years, one, if not the greatest, obstacle to the execution of the Prohibitory laws of the several States.

The Government loses far more in the moral effect of such a tax than it gains in revenue.

Every business is rightfully held responsible for its evil effects. Every State government should at once institute, by a competent Commission, a careful inquiry as to the amount of losses the State suffers from the traffic in alcoholic drinks, and should assess that amount upon the dealers, equitably, according to their sales.

Such a proceeding in each State would in five years entirely abolish the traffic, and would greatly conduce to the benefit of the public health and the public welfare.

If the General or State governments continue, impliedly or directly, to encourage and protect, or even to permit, the sale of intoxicating drinks, should they not at once erect, equip, and man, spacious asylums where they may send, for the double purpose of punishment and care, those who become drunkards, possessed of a vitiated and depraved appetite? In other words, does not the principle of self-protection require that governments should either protect their subjects from becoming *diseased criminals*, when possible, or provide means for a *curative punishment* for them when they do become such?

CERTAIN EFFECTS OF ALCOHOL IN RELATION TO LIFE INSURANCE.

By W. G. HARRISON, JR., M. D., *Baltimore*.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

Apostrophes to the "Flowing Bowl," depictions of the geniality and sociability of a cheerful glass are all very well in their way; and so also the other side of the picture is worth consideration: men may laugh over the inane jokes of Rip Van Winkle's carousals, and women may weep over his sad lot, when a long-suffering wife is at last driven to protect the house and home of her little ones from utter destruction. The question to which I ask your attention is precisely one of business; it is whether Rip Van Winkle could have obtained an insurance on his life?

In this age of the world, I presume life assurance has come to be recognized as a perfectly legitimate business, based on intelligible and practical data.

What effect upon such a man, in the point of view of a life insurance risk, have his habits in respect to the use of alcoholic beverages? The answer is not far to seek. Habits of excess in their use condemn a man absolutely. All life insurance companies take care to exclude from the list of their risks all those who cannot fairly be called "temperate," and even yet, so indefinite is this limit of "temperance," that the number of premature losses is known to be largely augmented by deaths due to indulgence in alcohol. And here let us vindicate life insurance companies, in the stand they take against the charge of prying unwarrantably into a man's personal affairs. It is not sufficiently borne in mind that a mutual life company is a pure co-operative association, having no existence apart from the lives insured. It is an association of *selected* lives, and the one principle of selection is to choose only such men as have a prospect of longevity. Obviously, therefore, any practices which tend to shorten life form proper subject of inquiry, and in adopting the rule in regard to this matter it is from no moral considerations, from no desire to force upon people a rule of living because it is virtuous, but solely because experience teaches that it involves pecuniary questions and liabilities. But does experience so teach? In answering this question it is matter of regret that the requisite amount of statistical evidence is not at present available for at once throwing sufficient light upon the subject. The fact is readily understood that in filling up "proofs of death," friends would be careful to conceal if possible, intemperance as the cause, and the medical attendant, who might have very good ground for a private opinion that his patient would not have died if he had not been a high liver, yet hesitates and may not feel called upon, to include the use of

alcohol as amongst the remote causes of the death. And so it must be frankly admitted that the mortality statistics of our American life companies do not furnish the data for an exact numerical estimate of the cost of habits of alcoholic indulgence. All that can be said is that the Medical Directors of life companies, knowing all that is known about the physiological action of alcohol, and carrying into their respective insurance offices the results of their daily experiences as practicing physicians, know full well that indulgence in alcohol is an important factor in causing many premature losses that are put down in the mortality list to pneumonia, to pleurisy, to brain disease, gastritis, nephritis, hepatitis, and I may add consumption and typhoid fever. Yet there are some statistics that to certain minds may carry more weight than these untabulated impressions, important as these are. Thirty-four years ago "The United Kingdom Temperance and General Provident Institution" was organized in London with the intention of restricting its business entirely to the class of total abstainers. After continuing in operation for some time it was found that the required class was not sufficiently numerous to reduce to the expected limit the cost of insurance. I need not stop here to explain how, in these mutual companies, the cost of insurance per capita varies inversely as the number of persons assured. Suffice it to say that the company in question found after a protracted trial, that they must extend their lines beyond the prescribed lines of teetotalism, or retire from business. They chose the former alternative, and while still excluding, like all other companies, applicants of intemperate habits, they accepted those whose use of alcoholics was called "temperate." All records of the two classes however, teetotalers and temperate users, were kept distinct, and the statistics of the company down to 1874 have been published. These statistics give the following result. In the class of teetotalers, the actual death-rate fell short of the expected death-rate a fraction over thirty-nine per cent. Amongst the temperate users, on the other hand, the actual death-rate again fell short of the expected rate, but in their case only to the extent of *one tenth of one per cent.* While I am fully aware that it is derived from too limited a field to entitle it to be taken as showing a general rule, these figures challenge examination. The cause of temperance will not and ought not to be advanced by taking up a position that is really untenable; and it behooves us to consider what answer we are to make to an argument based on the above facts;—for facts they are, no matter what inference be drawn from them. To me then, I may state very shortly, these figures help to enforce the lesson which daily observation teaches, namely, that the limits of temperate drinking are much too wide, and include a use of alcohol that is really excessive. A false nomenclature is, I believe, largely responsible for the blindness of people in general to the abuse under consideration. We speak of all alcoholics universally as "stimulants," and people are not quick to see that occasional or habitual "stimulation" to a mild degree, is fraught with danger. The fact, too little insisted on, is, that these agents are narcotics as well, and nine times out of ten, the man who flatters himself that he is "stimulated" is presenting the symptoms of incipient narcosis. The instruments of precision with which the physiologist

is armed, enable him to read better than in former times the phenomena which are the subject of his observations. With a thermometer to tell him of a lowered temperature; with a sphygmograph by which the heart shall trace the unmistakable evidence of its own growing impotence; — there is no need to wait for so gross a manifestation as "drunkenness" to indicate the pernicious influence of alcohol. Long before the cerebro-spinal system shows signs of succumbing, by the staggering gait and the faltering tongue, the sympathetic nervous system evinces unmistakable symptoms of paralysis; and the flushed face, the quickened pulse, the lowered temperature, the diminished blood pressure, give painful evidence of a profound disorder in the machinery of nutrition, — a disorder which is to be paid for, though unhappily it cannot be corrected, by the diminished dividends of the mutual partners of the insurance. You will pardon my recurrence to this point, for as stated in the beginning of this paper, my object is to present not a physiological statement of the subject, but to impress the one point that the directors of insurance companies, themselves of course coöperators in the enterprise, are coming more and more to understand that there is some undefined amount of risk attending all indulgence in alcoholic drinks (except it be of the most moderate kind); of course they do not understand all the physiological intricacies of the matter, nor is there any reason why they should. They simply say, as men of the world, guardians of their own and of other people's money, that they do not choose to subject their pockets to any such risk; or in the eloquent words of Dr. B. T. Richardson, of London, "if it be really a luxury for the heart to be lifted up by alcohol; for the blood to course more swiftly through the brain; for emotions to rise ecstatically, and for life to rush on beyond the pace set by nature, then those who enjoy the luxury must enjoy it, — with the consequences."

PERILS OF THE SCHOOL-ROOM.

By A. N. BELL, M. D., *of Brooklyn.*

ABSTRACT OF TWO PAPERS READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 13, 1874, AND AT BALTIMORE, NOVEMBER 10, 1875.

THE death of Dr. Francis E. Anstie, who was one of the brightest ornaments of his profession, was caused by a wound which he received in a post-mortem examination, while engaged in an investigation which had for its object the discovery of the causes of a fatal school disease, — acute idiopathic peritonitis, — a disease often found to be due to malaria, which, in this particular instance, was caused by sewer gas. I use the word malaria in this connection in its simplest sense, to signify bad air, but recognize the usual distinction of two kinds of malaria, vegetable and animal.

The diseases common to vegetable malaria, or marshy emanations, are unfortunately so well known as not to require special description. It will suffice to state that they are liable to be greatly modified and aggravated by animal malaria, the kind common to school-rooms.

Animal malaria may be engendered anywhere by the neglect of animal excretions, whether of mankind or of the lower animals. It is especially liable to occur as the result of crowding, darkness, want of ventilation, want of, or defective sewerage, and filthy habits; and is subject to intensification by extremes of temperature in crowded apartments. Crowding, or overcrowding, the more common term, is an indefinite expression, and so generally subject to misinterpretation by persons apparently incapable of understanding its true signification, in relation to school-rooms, that its limits require defining. The importance of air space rests upon the absolute necessity of pure air for healthy respiration; but the amount of space required depends upon a variety of circumstances. Hospital conditions, for example, require the largest amount of space, and modern experience has shown that, other things being equal, *no* inclosed space equals plenary exposure. But, for various practical purposes, the limits of space vary from 300 to 4,000 cubic feet, — the smallest proportion being the exaction for lodging-house dormitories, and the largest for hospitals, — making due allowance in all cases for space occupied by furniture. And *no deviation should be made on account of children*, whether in regard to the different members of a family or a school-room.[1]

[1] With regard to this point, Mr. John Simon well observes: "It is to be desired that laws and regulations as to overcrowding should not proceed on the assumption that children (to any measurable extent) require less breathing space than adults. Against any such assumption, two facts have been considered — first, that even healthy children, in proportion to their respective bodily weights, are about twice as powerful as adults in deteriorating the air which they breathe; secondly, that the children will almost invariably have

Moreover, it should be observed that the mere space allowance should in no case detract from the absolute necessity of means for renewal, and the smaller the space so much the more certain should be this provision. If 300 cubic feet only be allowed, the air must be changed, at the least, every twenty minutes. To neutralize the deleterious properties of respired air and to replenish it, every person requires 2,000 cubic feet of fresh air hourly, and with less provision than this, contamination is sure to follow.

The poisonous effluvia which pervades the atmosphere of close and unventilated rooms is not only re-breathed, but it adheres to all the surroundings; it sticks to the walls and furniture, settles into the drinking-cups, into the food utensils, food, and drink, permeates the clothing, and attaches to the person. It creates a nidus, which is not only in itself poisonous, perpetually lessening the vital force of all who inhabit it and predisposing to blood poisons of every kind, but it also becomes a hotbed for the planting and propagation of specific poisons, such as small-pox, scarlet fever, measles, whooping-cough, diphtheria, and the whole category of epidemic diseases, and a fruitful source of scrofula and consumption. The consideration of these diseases in detail, and their relations to crowded and unventilated places, would comprehend a treatise on the predisposing causes of epidemics. It may be stated in general terms, however, that the specific poisons which perpetuate this class of diseases are kept alive by the conditions common to school-rooms, always exist somewhere, and the history of them all demonstrates alternations of repose and activity, of prevalence in one place and absence in another, of successive invasions of contiguous neighborhoods and succeeding immunities. But the specific morbid poisons, the *seed*, never die; they remain and live on from generation to generation, ever susceptible to enlivening influences, and liable to transmission from place to place, renewing strength by the way, again to become dormant and lie in ambush, awaiting the return of congenial conditions for renewed activity.

The epidemic influences or constitution which some authors are wont to describe as conditions precedent to the activity of epidemic diseases, and which are believed to be periods of predisposing receptivity of specific poisons, are due in no small degree to the prevailing condition of school-rooms and their congeners. As a rule, the older these conditions — the longer the period of time in which they have been tolerated — the more depressed the vital powers of their occupants, and the greater their predisposing receptivity. Besides, the depressed state of the organism under such conditions is not only predisposing to epidemic diseases, but the liability to and the danger of all diseases is thereby intensified, and vicissitudes of weather, which under favorable circumstances may be encountered with impunity, under these depressing influences become dangerous perils; and, doubtless, much that is attributed to the season of the year supposed to be predisposing to

certain eruptive and other febrile disorders to pass through, from which adult life is comparatively exempt, and in which the requirement of space is greatly increased. And having regard to these two considerations, I think it best that children and adults should be deemed to require equal allowances of air and ventilation." — *Eighth Report of the Medical Officer of the Privy Council.*

scarlet fever, measles, whooping-cough, diphtheria, and some other common affections of children, is due to the same cause. It is, at any rate, very remarkable that, in our large cities, the beginning of the autumnal school term should be simultaneous with or speedily followed by the sickly term. There is surely something more than a mere coincidence in these relations; they stand much more like cause and effect. The effect of high temperature, in this regard, may seem to imply an exception to these conclusions. Heat has, indeed, received much consideration lately, as a sort of independent cause of disease, and to its influence especially has been attributed the excess of mortality common to infants in hot weather. Its influence is mainly due to its effect on organic matter, unventilated apartments, and filthy surroundings, conditions such as are usually present in close school-rooms and tenement-houses; and, above all, on the food of infants artificially fed.

Carbonic acid in school-rooms, in some respects, acts like heat. Dangerous and fatal as it is known to be, when in great excess, its importance, *per se*, is unquestionably very much exaggerated. Naturally it exists in the atmosphere in variable proportions from two to five volumes in 10,000. But, according to Dr. Angus Smith, no discomfort is experienced from the presence of carbonic acid in soda-water manufactories, when the amount is two volumes per 1,000, or more than ten times its normal proportion in the atmosphere. And Pettenkofer and Voit, in their experiments with this gas, experienced no discomfort from its presence, even to the extent of five times as much, or ten volumes per 1,000. Notwithstanding, *respired* air, containing only 1.5 volumes of carbonic acid per 1,000, is well known to cause headache, vertigo, and other painful admonitions of danger. And experience abundantly proves that whenever respired air, or the air of occupied apartments, is found to contain of carbonic acid more than one volume per 1,000, such an atmosphere is dangerous to health. It is apparent, therefore, that the ill effects of air which contains only a little more than one volume per 1,000 of carbonic acid, are due to other and more potent poisons. Such air not only contains, besides the excess of carbonic acid, and, not unfrequently, the more deadly carbonic oxide, dead and decomposing animal matter, and other mephitic gases and exhalations, but it is deficient in its very first life-sustaining property, oxygen.

The average amount of oxygen consumed by a healthy person is half a cubic inch every respiration, which in a day amounts to upwards of twenty-five cubic feet. And as oxygen constitutes but one fifth of the volume of the air, a single individual renders not less than one hundred and twenty-five cubic feet of air unfit for respiration, every twenty-four hours, by the mere abstraction of oxygen alone. Meanwhile, there is exhaled by the lungs about fifteen cubic feet of carbonic acid, thirty ounces of watery vapor, and an indefinite amount of organic matter, which has been variously estimated at from ten to two hundred and forty grains.

Besides the danger from active and fatal disease from exposure to the conditions which have now been described, all physiologists recognize the influence of depressing agents on the human organization in blunting the sensibilities, paralyzing the intellect, promoting stupidity, idiocy, and physi-

cal deformity. And in this relation at least, the "survival of the fittest" often has a painful significance, not alone confined to the present generation, but, recognizing the accepted law of inheritance, well calculated to shock the sensibilities in anticipation of the future.

Every organic body is so constituted as to have a time of development and growth ; a period of middle life in which the functions strive to maintain an unaltered mass ; and an epoch of decrease or decline which is concluded by natural death. These periodical changes are foreshadowed in the life of everything that lives. The same may be said of the component parts of the most complex organic body ; aye, every living cell which enters into the composition of any such body has an individual life of its own limited in duration, and liable to premature death under unfavorable circumstances. But at every instant, and under all circumstances, an organized body offers the sum of its vital operations to the advantage or disadvantage of health, according as it is affected by the vital condition of its integral parts. And all irregular actions, disturbances, and pains which follow any injurious influences, are just as much in accordance with the laws which govern the existence of a single living cell, as if the cell relied on its own independent action ; for it, too, like the body of which it forms a part, has a period of development, a period of maturity, and a period of decline. It is in accordance with these conditions that life is embodied.

The constant physical and chemical changes which accompany life depend upon the various reciprocities which are produced by the work of the different parts of the body ; the assimilation of what is received, the elimination of what is useless, and the restoration of the organs, by which these operations are effected. The series of functions by which these changes are accomplished may be summarized as follows : DIGESTION elaborates or separates the nutritive material from alimentary substances ; ABSORPTION provides for the transition of whatever is to be added to the blood ; CIRCULATION sends the blood throughout the system in order that it may be renovated and applied to the maintenance of the body ; RESPIRATION and CUTANEOUS TRANSPIRATION effect the exchange of gases, and graduate the temperature of the body by the exhalation of watery vapor ; NUTRITION maintains, increases, or diminishes, the mass of the constituents of which the entire organism is composed ; and EXCRETION throws off all worn-out and useless matters, the retention of which in the blood would poison the body. Meanwhile the SENSES receive impressions of the external world ; MOTION, with its attendant phenomena, leads to the change in space of particular parts or the entire mass of the body ; SPEECH, the peculiar gift of man, enables him to communicate with his fellows ; and crowning all these, INTELLECTUALITY, the highest function of the nervous system, the function by which we are capable of discerning the beauties of our mechanism and the endowments of our nature.

We need no reasoning to convince us that an organism so curious and so wonderful in all its parts as the human, was designed to continue as long as the material composing it will admit of ; and that upon us devolves the duty of giving it that continuance. Our duty is known from our nature. What

we ought to do for ourselves is as fully understood by a knowledge of our organization and powers, as the uses of any machine are understood by an acquaintance with its construction.

The preservation of health is an incumbent duty. We must preserve it in its most perfect state, that in which the powers of the constitution can be best exerted. All the health and strength of which we are capable were intended for use; and any unfitness for the functions of life is a partial death, by a suspension of the compensating powers of the system. The life and activity of every part is merged into an organism so perfect, that all the parts of which it is composed are united together into a bond of mutual support, and the complete performance of the *entire series of actions* is necessary for the health-maintenance of any one action. All the functions are so completely bound up in each other that none can be suspended without seriously embarrassing or causing the cessation of all the rest. And if any one organ is diseased, others come to the rescue; and in remediable states, the functions of the diseased organ are exercised by other organs until health is restored. The functions of nutrition and elimination, especially, are so adapted to each other that the corporeal mass is never suddenly altered, but income and expenditure are always adapted to the equitable growth and maintenance of the system; so that we have a regular clock work, as it were, which is always correct within certain limits, and which ever strives to maintain its ordinary rate in spite of disturbances.

It is one of the characteristics of the human organism that the period required for the attainment of complete maturity is much longer, in proportion to the entire term of life, than it is among other animals. And, from the first, the current of nutrition is directed with peculiar vigor to the brain.

In infancy and childhood the size of the brain is considerably larger in proportion to the size of the body than at a subsequent period; it differs also very materially in its structure, the amount of water, especially, being greatly in excess.[1]

The brain has advanced to near its term of size at about ten years, but it does not usually obtain its full development till between twenty and thirty years of age, and undergoes a slight decline in weight in advanced life.[2]

That the organ of the mind is but the outgrowth and ultimate development of the tissues and organs of which the body in general is composed,

[1] Of the structure of the brain at different ages, L'Heretier gives the following table, the numbers in each instance representing the mean of six analyses: —

	Infants.	Youths.	Adults.	Aged Persons.	Idiots.
Water	82.79	74.26	22.51	73.85	70.73
Albumen	7.	10.20	9.40	8.65	8.40
Fat	3.45	5.30	6.10	4.32	5.00
Ozmozone and Salts	5.96	8.59	10.19	12.18	14.82
Phosphorus	0.80	1.65	1.80	1.00	0.85

Traité de Chim. Pathol., p. 596; Simon's *Chemistry of Man*, p. 616.

[2] Owen's *Comparative Anatomy*, vol. iii., p. 144.

and that its office is to unite all the functions and faculties into one common bond, is among the most obvious conclusions of modern physiology.

It has been variously estimated by different authorities that in early childhood from one fifth to one fourth of all the blood in the body is directed to the brain. The whole mass of blood traverses the entire body about once a minute. The wonderful activity of the circulation may be better appreciated by estimates proportioned to greater lengths of time. It will then appear that the heart contracts more than four thousand times an hour, and that as each contraction sends forward four and two fifths ounces of blood, over one thousand pounds of this fluid pass through the heart every hour! When the blood has completed one tour of the system, it necessarily passes through the lungs before beginning another. This route is intimately connected with the purification of the blood. It is by this means the blood absorbs oxygen from the air, and parts with carbonic acid and other noxious elements. Oxygen is the agent of nutrition to all the tissues; it is the great inciter of vital changes, and its presence is indispensable to life and growth. *If the blood passing through the lungs does not there obtain a supply of oxygen, it takes back to the brain and other tissues carbonic acid instead*, and the consequence is an arrest of the changes necessary to life and growth. If in passing through the lungs the blood meets with only a small supply of oxygen, — or that which amounts to the same thing, air surcharged with carbonic acid, — a partial arrest of vitality takes place, the vigor of the organism is diminished, the functions are depressed, and there will be a gradually increasing torpor of the mental faculties, and ultimately, a stunted intellect and premature death.

We are all so placed that there are very few of the objects surrounding us which may not be serviceable or hurtful; nor is that service to be obtained or injury avoided, otherwise than by an acquaintance with things external, and their relations to our existence. The more exact our knowledge of this kind is, the more we lessen the calamities and add to the comforts of life. Indeed, the whole theory and practice of education involves the distinct recognition of external influences, as having the most important share in the formation of character. And it is the object of every enlightened educator to promote the right exercise of that power by which each individual ultimately becomes the director of his own conduct, — the arbiter of his own destinies. The first necessity in the accomplishment of this object is the preservation of health; and the problem of education yet to be worked out is, — *the balance of physical forces and intellectual faculties.*

That the conditions of Education as ordinarily conducted are in terrible conflict with this balance, no careful observer will attempt to gainsay. They comprehend an *ensemble* of causes, which act profoundly on the health of both body and mind at that period of life which above all others is the most tender, and the most vulnerable to depressing influences; the time when the foundation of an unhealthy constitution can be most easily laid, and intelligence most effectually impaired.

Nature in some respects can be made to deviate from her ordinary course of procedure in order to be subservient to the purposes of men. By the

persistent lopping off of branches, pinching the buds, clipping the roots, withholding nutriment, and the deprivation of air and light, the great oaks of the forest may be reduced to insignificant bramble bushes. The fruit trees of our gardens may be in like manner dwarfed, and, by grafting on hardier roots, under constant nursing, be made prolific in the perpetuation of their feeble species. But leave them alone for a time, and like the hollow-eyed, bleached, and feeble progeny of a common school-room, they have no stamina, — hot-house plants, destined to perish on the very threshold of life.

For high culture, for the perfection of organic development, " other foundation can no man lay than that is laid."

If a child of originally healthy constitution be subjected for a sufficient length of time to an atmosphere surcharged with carbonic acid; if it be deprived of light; if it be restrained in the physical exercise necessary for the development of its organs; if the "wants of nature" be neglected; if, above all, the want of supervision which renders these conditions common to school-rooms be extended to a negligence of the virtues of school children, and teachers continue to be purblind to that nameless vice of our schools which saps the very foundation of nervous energy — what else can we expect but a generation of dwarfs, a stunted progeny?

The change of structure which invites such extraordinary functional activity during the period of childhood, is marked by a corresponding excitability of the whole organism and a greatly increased susceptibility to external influences. Hence the peculiar liability to certain diseases, — to infantile disorders of every kind, — and especially to brain complications. This is particularly illustrated by the influence of remedies. All physicians are familiar with the fact that whilst a child will bear a fourth or even a third of a dose of a purgative medicine adequate for an adult, medicines which particularly act upon the brain cannot be given with safety in more than one third of that proportion; stimulants and narcotics have to be given with very great care. The excessive impressibility of the nervous system of children in consequence of the functional activity taking place in the brain, also manifests itself in other ways; they are peculiarly liable to have their powers depressed by sudden shock, from apparently slight causes; not only from physical injuries, such as blows, falls, or burns, but from fright, or from sudden changes of temperature, and from improper food; and more gradually, but not less fatally, from breathing impure air.

A due supply of unadulterated air to the respiratory organs is recognized as among the most important conditions of health at all ages and under all circumstances, but at no age is this so essential as during childhood. Air vitiated by respiration is not only known to be among the most active influences in promoting the spread of many fatal diseases, but on young children who may escape these diseases it exercises a powerfully depressing influence. A person consumes about two gallons of air every minute, or one hundred and twenty gallons per hour; and every pulsation of the heart decomposes nearly a quarter of a pint of air. Hence it follows that if the air remains subject to re-respiration, or is not supplied with a due quantity

of oxygen, functional activity is obstructed, nutrition is interfered with, and the sensibilities are blunted ; the brain of the child is filled with impure blood, and is not only itself depressed, but through it the whole organism is deranged ; and although life may not be speedily destroyed as in extreme cases, the intelligence is stunted and mental capabilities overthrown.

In proportion as the sum of the sensations is increased by the progressive development of the nervous system, the organic functions are exercised ; sensations and motions, which were at the first confused and unsteady, acquire accuracy, and education virtually begins involuntarily. It should be cultivated with regard to health by a thorough protection from injurious conditions. The faculties of perception — memory and imagination — are always preceded and determined by sensations, and these are capable of being enlarged only in proportion as new excitements call them into exercise. With the increase of age and cerebral development, while the nervous system ever presides over and governs the healthy organism, it no longer maintains a preponderance of functional activity. It is, however, in intimate relation with every organ in the body. And it is at this age, the age at which the brain has advanced in structure "to near its term of size," that systematic education may with safety be commenced. To fix the period more definitely, from physiological relations, would be difficult.

If it be practicable, and I think it is, to teach children the rudiments of education, comprehending letters, reading, and figures, before the age of ten, without restraining functional activity, on the kindergarten system, so much the better ; if not, they had better not be taught at all. Children differ greatly in regard to their aptitude in this respect, however, notwithstanding the more general similarity in the immature condition of the brain. And it is not uncommonly the case that those who show the greatest aptitude in consequence of excessive functional activity, are the most liable to bad results, and require the greatest caution. Freedom of muscular motion, and the due exercise of all the functions up to this period, are essential to the healthy development of the brain, and no risk should be taken in its premature exercise lest its nutrition be interfered with, and permanent injury inflicted.

Sex, up to the age of ten or twelve, ordinarily has no disturbing function, and is entitled to no consideration. But, subsequent to the period of adolescence, the higher and best education of the sexes is only to be attained apart. And, recognizing the physiological differences, the different nutritive and other changes in progress in the two sexes between the ages of twelve and twenty, it cannot but be surprising that the same training should be advocated for both by any one competent to conduct a school. But so long as physiology and common sense continue to be disregarded in the most ordinary affairs of education, so long, it may be reasonably supposed, this absurdity, among the rest, will find advocates.

Physical Education should go hand in hand with mental education, for both sexes. And it is the more essential in the inverse ratio to the age of the pupil ; and in all cases, where practicable, physical exercise should be taken in the open air. There should be more frequent sessions, shorter

periods of confinement to school rooms, and more "play." It is too commonly the case, that physical exercise is looked upon as mere relief from mental exercise; it is not regarded as it should be, *as a contribution to mental culture*, as well as bodily, increasing its vigor and promoting its power.

School-room crowding continues to be an evil of the greatest magnitude. And in some of our cities, both private and public schools, are comparable with the most odious conditions of New York tenement-houses. Examples of both might be cited, giving less than fifty cubic feet of air space to the scholar; and with rooms thus crowded, so situated that the sun never shines upon them; with heating appliances without any provision for moisture in the atmosphere, and so badly constructed, as to be constantly contributing, not only carbonic acid, but the more deadly poison, carbonic oxide. One such in Brooklyn, I have visited since the present cold weather commenced, which, to make amends for deficiency of heat from four old hot air furnaces, had piled round their red hot pots quantities of iron shavings — old hoop-iron and tin scraps — all heated red hot, and giving out their mephitic gases to rooms crowded, one of them to the extent of one pupil to every thirty-one cubic feet of air space; and the whole structure, including a detached building, with a registry of 1,300 children, and generally full attendance, with an average of air space per pupil throughout, of less than fifty cubic feet. And as if this were not bad enough, the building is in a marshy, soil-saturated district, with a cellar privy on each side not sewered. I believe this is the worst public school-building now remaining in Brooklyn, for there have been some improvements recently, but I am not sure.

I might also cite some private schools with almost equally bad appointments, but I do not like to make invidious distinctions, and especially in regard to the city of my home. I am satisfied from inquiries that the school-houses of Brooklyn, in general, will compare favorably with the school-houses of our other large cities, but none of them are fit to be compared with anything else than with one another, except tenement-houses. They are of a piece, and only equally disgraceful to our civilization; equally inconsistent with recognized principles for the promotion of health, and both alike should give place to smaller, and proportionately more numerous, better situated, and healthy buildings.

III.

SANITARY ENGINEERING: — DRAINAGE, SEWERAGE, AND CLEANSING.

CERTAIN RELATIONS OF GEOLOGY TO THE WATER SUPPLIES OF THE COUNTRY.

By EDWARD ORTON, A. M.,
President of Ohio Agricultural and Mechanical College, Columbus, Ohio.

A DISCOURSE BEFORE THE ASSOCIATION AT ITS ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 12, 1874.

I ASK your attention to a brief discussion of one of the points of connection between Geology and Sanitary Science, — that noble application of Natural Knowledge to the relief of man's estate, which our own age may be said to have produced. The connection to which I refer is found in the natural water-supply of the country.

It is obvious that this subject comes within the range of geology, water descending through the air as rain, dew, or snow, or existing in the air as invisible vapor, or in clouds, — those wandering cisterns of the sky, — is referred to the domain of meteorology, but even here a more thorough examination shows us that its aerial distribution and state are dependent on geological facts, and justify its reference from a broader view to geological science. But it becomes the undivided and undisputed subject of this science from the moment that it falls upon the surface of the earth, whether gathered into lakes and seas, whether flowing in rivulets and rivers, whether descending through soil and strata to feed the roots of growing plants, to form the springs that run among the hills, or sinking deeper, deeper still, toward the earth's glowing foundations to take part in earthquake shock and volcanic eruption. In all of these relations and offices, it does not merely make a contribution to geology — it rather constitutes geology. Geology has a vital interest in every step of its progress and in every moment of its activity. As surface water, it chisels out the valleys, small and great, by which the relief of the land is produced, or if carried below the surface it dissolves and re-dissolves the various mineral compounds that lie

NOTE. The geological facts referred to in this paper are drawn mainly from Central and Southern Ohio.

along its path, honeycombing the solid rock with crevices and caverns; supplying to the living creation to-day the identical atoms by which its prototypes grew in the morning of the world or filling the rents and chasms of the rocks with metallic wealth. Where the water shall go, whether by surface drainage to the sea, or beneath the surface to issue in springs or be lost in subterranean recesses, what it shall *do* in the way of solution or mechanical action, all these questions are, as I have said, not so much the problems of geology as geology itself. Upon the other hand, sanitary science gives to water an equally important place. Among the indispensable conditions of human health, three factors stand out prominently; pure water, pure air, and nutritious food. As a necessity of his organization, in every stage of his advancement, man has always counted water-supply as second only, and scarcely second to a supply of food. Genesis fixes the location of man's first home at the head-springs of a river; that it was by river or spring, we may be sure. The value that men set on this supply is shown by a bit of oft-recurring human experience, fossilized in a word of every-day use, namely, *rivals*. *Rivals* were men who dwelt on opposite banks of the same *rivers*, or *rivulet*; they always quarreled over its ownership. There are to-day no more stubbornly-contested cases in our courts than those that relate to water privileges. No wonder that we set so high a value on the water that we drink, — for of the 150 lbs. avoirdupois, that constitute an average man, 116 lbs. are water. If the character of the supply is good, there is life and health in every draught; if its hidden sources are poisoned or polluted, it spreads pestilence and death along its course, or worse than this, if it has dissolved and holds in solution too large an amount of the mineral substances through which it flows, it transforms those who drink it into dwarfed and hideous idiots.

There is this difference in the interest with which the two sciences regard the waters of the globe. Geology is interested in the whole supply and in all of its agencies and effects. Sanitary Science is principally concerned with that portion of the supply to which man resorts to quench his thirst; its interest is mainly limited to water-courses great and small, with the lakes through which they flow; to springs and fountains; to the veins and sheets of water which, though buried beneath the surface, are still accessible to man and from which he draws his daily supply. But even though the common interest of the two sciences in this subject is granted, some one may ask, "What advantage can Geology render to Sanitary Science?" Sanitary Science is of all things practical, engrossed with useful applications, intent on a homely end. Of what use can the teaching of geology with its far-fetched and fine-spun theories be, to such a science and on such a topic? I answer, much every way. Geology has her theories, grand and far reaching. She essays to answer almost all of the questions which the Lord put to Job out of the whirlwind, but she has also a practical side. She does not shrink from the humblest details. The facts that she acquires for other purposes and of which she makes other applications, have the most intimate and important connection with the water-supply upon which man depends and the application of sanitary science to this vital point is simply impossi-

ble, without the possession of the very knowledge which it is the business of geology to acquire.

Our water-supply is derived from the rain-fall. I will not ask how the water found its way into the air: all that our present purposes require is that we clearly recognize the fact that fountain, river, and lake, are alike fed from the clouds, and that man is wholly dependent for his supply of this vital element on the rain that comes down from heaven. He may dwell on plains as arid as the mountains of Gilboa, but he drinks from the stream that flows past his feet, — which itself is fed by floods that fell a thousand miles away: and whatever mystery attaches to subterranean waters we may be sure that by a long enough circuit we can trace every drop back to the clouds. The rain that falls upon the face of the earth has various fortunes: a part of it — storm-water — washes the surface, carries away from it in suspension many of its finely divided particles, dissolves what it finds easily soluble along its path, is gathered into open drainage channels, and, forming part of some river-system, hastens to the sea. It touches geological problems at every step of its way. From the sandstone and conglomerate hills of Western Pennsylvania and New York, the soft water of the Ohio is derived. If the descending rains find nothing but granite ledges and the thin soils formed from them, the streams into which they are gathered become the standard of comparison for all natural waters containing, as in the Swedish River, Loka, but one twentieth of a grain of foreign matter to the gallon; but a very considerable portion of the rainfall enters the earth, and is lost for a time from sight. Can we follow it in its underground courses? Yes. Geology becomes a light to our feet and a lamp to our path as we trace the slowly-descending sheet. The soil, most valuable of all geological formations, made up of crushed and weathered fragments of the rocky crust, first receives it. It sinks rapidly through this thin and porous covering, — through whatever porous beds lie beneath it until it is arrested and turned outward by an impervious layer. This layer may be found at a depth of one foot or one thousand feet below the surface, and the porous beds that intervene between it and the surface may exhaust the whole category of geological formations: they may consist of sand, gravel, or gravelly clay, of shale, sandstone, limestone, or granite. So also a considerable variety of composition is represented in the impervious beds: a layer of clay is the most common water-bearer, but seams of shale, or tables of limestone or of granite, answer the same purpose in a thousand instances. It is not composition alone that determines this point: beds that are naturally altogether impervious may allow a free transmission of water through them, by reason of the accidents of their geological history to which they owe the fractures and joints that now divide them. But note, — the water that emerges in the spring is never identical in character with that which fell in rain. It is not without result that it has been wandering for days or even weeks and months through the strata. When it fell from the clouds it was not absolutely pure water: it had washed from the air the germs of animal and vegetable life, it had absorbed in its descent the various gases that enter into the

composition of the atmosphere, and by them had been endued with new power for its subterranean tasks. Rain-water is a universal solvent. Some substances it dissolves very slowly, — so slowly that we say in ordinary language, in does not dissolve them at all. Of the so-called insoluble compounds, silica, the most abundant of the substances that compose the earth's crust, is chief: wherever highly silicious beds receive the rain-fall, — either as unconsolidated sand or as sandstone or granite rocks, — the water that flows through them is least affected by its stay underground; and more than this, as silica when dissolved is a harmless impurity, and as its finely-divided but porous beds constitute a natural filter by which all forms of suspended matter are removed, the water obtained from these beds has the highest character of all natural supplies.

The springs that issue from the mountain glen, which become to every one who has ever stooped to drink of their cold and crystal waters unapproachable standards of excellence, have very often such a history. But among the substances which the slowly sinking sheet of water traverses, there are many of a much greater degree of solubility: the compounds of soda and potassa, of magnesia and lime, of phosphorus and sulphur and iron, are taken up in various but comparatively large amounts. Lime and magnesia are most common and abundant of all: contrary to a commonly-received opinion, absolutely pure water does not seem so conducive to life and health as water containing a certain proportion of these salts. The proportion, however, must be definitely limited: the presence of six, eight, or ten grains of the salts of lime to the gallon is counted by high authorities as a definite advantage in several respects. A higher limit was fixed by the Sanitary Congress that met at Brussels, at thirty-five grains to the gallon. Water containing more inorganic matter than this, is to be counted unfit for use as drinking water. The presence of an excessive amount of lime and magnesia in spring-water has been quite definitely connected with goitre and thus with cretinism. There are not facts enough accumulated to make the induction safe and strong, but it is hard to resist the conviction that the water-supply is, at least in part, a cause of this first-named deformity. When the water dissolves any notable quantity of other substances that the strata may chance to contain, — such, especially, as compounds of potash, soda, iron, and sulphur, — the emerging springs are termed mineral springs, and account is made of them for medicinal purposes; but it does not concern us now to discuss this group of natural waters. There is, however, a very distinct class of substances which rain-water finds in and beneath the soil, and which it has power to dissolve, namely, substances of organic origin, — derived from the vegetable and animal kingdoms. All soils contain a greater or less proportion of vegetable matter. There are large areas which consist — to a depth of many feet — of little besides half-decomposed vegetation. The products of decaying vegetation are soluble, as is shown in the coffee-colored streams that flow off of peat bogs. So all spring-water that descends through tracts covered with vegetation — and especially that which is derived from cultivated land — contains these products of decomposing vegetation. Such water may be unpalatable, but can scarcely

be said to be unwholesome. Decomposed vegetation exerts a poisonous influence when it escapes in the dry way into the atmosphere, but in aqueous solution it is comparatively innocuous. It is far different with substances derived from the animal kingdom: these turn the drinking-water with which they are mingled, sometimes into slow and subtle poisons, and sometimes into the agents of a swift destruction. Two dreadful scourges of the race, typhoid fever and cholera, are in particular connected often in origin, and much more frequently in transmission, with the supply of drinking water. It has been abundantly and conclusively proved that drinking water contaminated with the excreta of persons suffering from either, is a common carrier of their germs. I will not detain you with any extended recapitulation of the evidence, probable and conclusive, which traces typhoid fever and cholera to such contamination. The records of the medical profession and of sanitary science for the last few years, in our own country and in Europe, furnish a demonstration of the connection of which I speak. Two or three cases, however, I venture to lay before you, as specimens of the line of proof on which these statements are based: —

At a meeting of the American Public Health Association held in New York in 1873, Prof. Austin Flint, Sr., gave an account of "an outbreak of typhoid fever in Vermont," which it was possible to trace in the most circumstantial way to the poisoning of a well by such modes as I have named. A young man travelling through that region by stage coach was taken ill, and when he could go no further, was left at a tavern in a little hamlet to be cared for: the illness proved to be typhoid fever. A small water-course in a shallow valley, divided the hamlet into two portions, each of which consisted of a half dozen houses or less. In the course of a few days, new cases of the fever made their appearance in that part of the village to which the tavern belonged: every house, in fact, was invaded but one, while on the other side of the stream not a case occurred. It appears that the tavern-well, which was the only one on that side of the village, furnished the water-supply to all the families but one belonging there. That family had had a falling out with the landlord — "an unpleasantness" — to use an expressive Americanism, and had consequently deserted the tavern-well for a more distant supply, and so had escaped drinking the specific poison by which all of their neighbors were stricken down.[1]

Another example I draw from the story of the famous "tea-water pump" which during the cholera visitation of 1854, in London, killed five hundred persons in a single week, in one of the fashionable localities of the city. It has long been known that water containing five or six grains of lime and magnesia to the gallon, is much preferred for making tea, to water of any other quality. The lime prevents the water from dissolving the astringent matter of the leaf, yet does not interfere with the abstraction of its desirable constituents. Certain wells, then, that have this proper proportion of mineral matter, come to be valued very highly by persons of nice taste. Readers of Don Quixote will remember the extreme delicacy to be attained

1 "The Relations of Water to the Propagation of Fever." By AUSTIN FLINT, M. D. *Reports and Papers of American Public Health Association*, vol. i., pp. 164–172.

in the matter of testing wines by good gifts and long practice: it would be uncharitable to suppose that imagination or fashion ever intrude into such a field as this. At any rate, the Broad Street pump, near Golden Square, London, was known to furnish in its cold and sparkling waters a better medium for "the cup that cheers but not inebriates" than was elsewhere to be found. When the cholera invaded this neighborhood, the wealthy residents retired to the fashionable suburbs that were still uninfected, but the cholera broke out among them there with terrible severity; the health officers soon discovered that those who were attacked, had sent in every day to the Broad Street pump for their water-supply. An incident connected with this outbreak, will, I am sure, appeal to our better feelings. A wealthy spinster who was not so tired of life as to sit quietly down in the paths of the pestilence upon its approach, withdrew to Hampstead; her *tea* was dear to her, and every day her serving-maid was sent three miles to the Broad Street pump for a kettle of tea-water; the spinster and her maid were the only persons attacked by cholera at Hampstead. To find the pestilence using such trusted media as this is as harrowing as for the eagle to "view his own feather on the fatal dart."

The third case that I will instance in this connection is the following: A few years ago, enteric typhoid fever broke out with great violence along certain streets of a town; there was absolutely nothing in the surroundings of the families attacked to show why they were taken and their neighbors left; and the case seemed at first to be one of those of which the world but a few years ago was so full, but which have grown to-day to be very rare, and are found not to require for their explanation the arbitrary decree of an inscrutable Providence. It happened in the instance here noted that all of the families attacked were supplied with milk by the same milkman. You see the rest, — the milkman's pump, which generally works in the interest of dishonest gains, was here made the agent for distributing through a score of families the seeds of disease and death. It is but justice, however, to state that no charge was made of any gross dilution of the milk: it was given out that the small quantity left over in the cleansing of the milk-cans had spread the infection. To those of us whose knowledge of human nature has been gained on this side of the Atlantic, such an explanation betrays altogether too trustful a simplicity, and would be impatiently whistled down the wind. "*Credat Judæus.*" The only improvement which the story, read in this light, seems to demand, is expressed in the old proverb, "*Murder will out.*"

I have now made the general statements that my subject requires. Our water-supply is derived from the rain-fall. The rain-fall flows *over* the surface in superficial drainage, or disappears *beneath* the surface, sinking slowly and quietly through beds of sand and gravel, and gravelly clay, and through solid rock, until it reaches an impervious layer, the outcrop of which becomes, wherever it is found, a horizon of springs, and the surface of which becomes, when the beds that hide it are pierced by shaft or drill or driven tube, a reservoir for wells.

When it flows over the surface it dissolves some of the material it meets

with; but in its more leisurely underground progress, it takes up large quantities of foreign materials, some of which in certain proportions seem to increase its adaptation to human needs, and others of which are liable to convert it into a specific and virulent poison.

I ask you now to notice a few of the applications of these general principles to our own surroundings, or in other words, to consider briefly the relations between the geological structure and the water-supply of Ohio. Two great divisions of the surface of the State must be recognized in considering its water-supply. In far the larger portion of its area the water-supply is derived from the Drift, — the most recent of geological formations, and at the same time the most anomalous and perplexing. In a smaller portion of the State — where the surface consists of the outcrops of the various rock formations of its geological scale, with the thin covering of native soils which their weathering has produced, or with shallow deposits of drift — the water is borne by the rocks themselves. Let us examine these two divisions in the order in which they have been named.

I. All theories of its origin, and all phases of its history being left out of the account, I will refer only to those features of the Drift that immediately concern our present purpose. It is known to all that the rocky floor of the country north of the fortieth parallel is hidden from view in by far the larger portion of its area; in Madison County, for instance, but three exposures of the underlying rocks occur, and these are of but very limited extent; probably not one person in a hundred of those born in the county has ever set eyes on any of these outcrops. It is not thus obscured by the products of its own weathering; but heavy deposits of foreign origin, often having no similarity in composition to the underlying beds, have been laid down upon it. These deposits vary in thickness from a few feet to several hundred feet. They consist of sand and clay and gravel and bowlders variously arranged and intermingled. While no tabular view of the order of arrangement could be furnished that would fit every locality, it may be said in general terms that the lowermost of these deposits is the extremely compact and tenacious blue clay, commonly known as hard-pan, containing occasional bowlders, and scattered and irregular seams of gravel and sand. Over this, and often separated from it by quite a distinct boundary, are beds of sand, of gravel, and especially of a yellow, gravelly clay, sometimes formed from the weathering, and sometimes having a very distinct origin. The blue clay is almost or altogether impervious to water; the remaining beds are, with local exceptions of limited extent, thoroughly permeable. There are sections of the State in which the blue clay constitutes the surface. In such cases but very little of the rain-fall is able to enter the ground, and springs are almost impossible; while the wells are cisterns filled from surface-drainage rather than living fountains. In the central district of the State, the porous beds of which I speak are almost always present. They vary in thickness from five to fifty feet, but in by far the greater number of instances they are between the limits of ten and twenty-five feet. You will not fail to recognize the beautiful adaptation of this structure to human uses. The blue clay is the water-bearer, the porous beds overlying

it are the filter. The rain-fall, after being contaminated with the soluble materials of the immediate surface, must be strained through fifteen or twenty feet of filtering beds before it can be accumulated for the use of man or beast. There is no reason whatever for believing that the surface of the water-bearing clay is a level surface; there is, on the contrary, every reason for believing that its surface is at least as diversified as is that of the superficial beds that cover it. There are found within it reservoirs or wide sheets of water, and there are narrow channels by which the water is slowly moving outwards.[1] The extent of these reservoirs explains the success which so often attends the labors of the sorcerers and diviners, who locate wells by the help of a forked twig.

Let us make application of the general principles already enumerated, and of the particulars of geological structure just given, to this region. The water depended on for daily use is, in the great majority of cases, obtained from wells. What is a well? Generally it is a cylindrical shaft sunk to the surface of the water-bearing bed. As we have no other purpose in sinking the shaft but to reach the water-reservoir, we are prone to think that the shaft confines itself to the simple and useful office of furnishing a way to the water. But not so. There is another office which, in the nature of things, it must discharge. The shaft is a *drain*, as well as a way to water. The principles of land drainage are now quite generally understood, but a very important application of them to the subject which we are considering seems to have almost entirely escaped observation. A drain cut through a soil of ordinary porosity will draw water for varying distances, in proportion to the depth of the drain. Drains sometimes open into a pit, six or eight feet in depth, in some central locality, the drainage-water being perhaps removed from this pit by artificial means. But the pit itself would, without the intervention of draining tile, constitute a drain for a certain area around it. A drain five feet in depth will, even in a compact soil, effect an amelioration of it for at least twenty-five feet on each side, and the pit in question would certainly exert a similar effect on the contiguous area. But if the pit be named a well, it does not thereby lose this power of drawing water from the area adjoining it. The well then is a vicarious drain, and often an effective one, for the ground about it. A part of its regular supply of water is close at hand. How far do we need to go to find the balance? Not so far as we sometimes think. There is a great deal of mystery in the minds of the multitude in regard to subterranean waters, much of which would be dispelled by a little mathematical calculation. The average annual rain-fall of Central Ohio is forty inches. Every square rod of surface must receive about 6,700 gallons of rain annually; supposing two-thirds to escape as surface-drainage, a rood would still furnish 90,000 gallons to the reservoir

[1] There are at least 2,000 square miles immediately to the west and south of Columbus, Ohio, to which the above statements would, in the main, apply. Madison County, already named, lying central in this region, may be taken as a proper representative of it. There is no district of the State better provided, on the whole, with water, and there are many with a far less adequate and satisfactory supply. We may take this supply, then, as a favorable sample of the water furnished by the Drift; and whatever question can be justly raised in regard to the supply of this region as it is commonly obtained, will have still more force when asked with reference to other similar portions of the State.

below. Reduced to another standard, we should find more than seventeen tons of water descending through this area. Remembering the treatment that the surface immediately about the well too often receives, we may be willing, or even anxious to look beyond the door-yard for the sources of our fountains; but we must hold fast to facts; the yard is a part of the porous surface of which we have spoken. That the rain descends upon the evil and the good, is as true for soils and surfaces as for their owners; the rain disappears below the surface; there is absolutely nothing to prevent the filth-soakage of the yard, with all its abominations, passing by a short course to the well. Nothing to prevent? There is everything to make this result inevitable. This surface contamination of wells is no problematic and possible source of infection; it is actual and imminent. In the terrible outbreak of cholera of 1873, in Kentucky, numerous cases were recorded in medical journals of the west, of the rapid diffusion of the pestilence by means of wells poisoned in precisely this way. One darker corner of the premises still remains to be considered. The cesspool lies within the area of influence; it is generally an uncemented pit, dug in the porous beds of which we are speaking. That these beds do not lose their porosity because turned to such a purpose and known by such a name, is evident from the fact that these reservoirs of impurity so seldom overflow; their liquid contents disappear. Where do they go to? Where all surface water goes, — to a lower depth, to mingle with the great sheet beneath, from which our supplies of drinking-water are drawn; or if a draining pit, sunk to two or three times its own depth is at hand, to that pit it will hasten by the shortest routes, even though we call this pit a well. It is physically demonstrable that in multitudes of instances the cesspools feed the wells.[1] The additions to the cesspool of one day, are pumped from the well on the next. Nay, the great law of habit applies to underground water-ways no less than to human character. Where the water goes one day, it is more likely to go the next; direct channels of communication will be established to meet the daily demand. In some instances, a marvelous rapidity of communication

[1] In speaking of the drift thus far, I have confined myself to the upland drift of Central Ohio. One great and important division I have left wholly out of the account, namely, the river valleys. These broad and fertile terraces constitute, especially in the southwestern corner of the State, the most attractive and most valuable portion of its area, may I not say, of the area of Ohio. In the fact that rivers are almost always found near great cities, just where they are needed, the optimistic philosopher found a proof and an example of the benevolence with which the world is ruled. A similar example is found in the fact that these beautiful and productive plains lie near to and underneath the chief cities and villages of all this region. These terraces furnish, indeed, most advantageous sites for towns. They consist of sand and gravel in large measure, and to this structure they owe their chief attractions. But this same structure renders them unfit to be used for the water-supply of the towns built upon them; for although an abundance of clear and sparkling water can easily be reached, it must not only be looked upon with suspicion, but must be positively condemned as unsafe. These gravel beds are as porous as a sieve, and there is indisputable proof of the free communication between the water-sheet and all the receptacles of impurity that the surface of the ground contains. The only relief is found in the fact that the water-sheet is also in free communication with the rivers, rising and falling with them; but even this does not free the wells from the poisonous effects of filth-soakage from above.

is found to exist. A case is recorded in England, in which chloride of lime was thrown into the cesspool, and the adjoining well instantly yielded chlorinated water.

Do you ask — what are these vaunted filter-beds doing all this time while the wells are being fed from these vile sources ? I answer, they are doing their appropriate work steadily and well; they are clarifying all of the water that flows through them. It requires but a few feet of these natural filters to thoroughly remove the solid particles with which the water enters them. They generally remove both color and odor also from the surface water. In some respects they effectually purify water. Give them time enough and they will transform the foulest and most noisome sewage-water into the crystal springs which poets celebrate in immortal verse and which even religion takes as the type of its best gifts to man. But time they must have, and they can gain time only by the intervention of sufficient distance between the points of supply and delivery. Their agency in this part of their work is not mechanical simply; they depend on the air which they hold for the decomposition of all offensive compounds, and this process of underground oxidation is comparatively slow. The danger lies in the overtasking of the filters; in requiring them to dispose of sewage as well as of rain-fall. It cannot be too distinctly understood that *clear* water is not necessarily *pure* water, any more than cool air is pure air. A city-well may give no warning to any sense: its waters are refreshingly cool, for they come from a sufficient depth; they are clear and sparkling, for they have been strained through a filter adequate to free them, not only from all solid particles but from all color also; they may even give no odor; at least, those accustomed to their use will detect none, and yet they may be laden with the germs of the deadliest pestilence. Such cases have happened a thousand times. The explosive outbreaks of cholera that have often been limited to single tenements in a city or to single blocks or streets, are, in the light of recent sanitary researches, without a doubt to be referred to this cause. The suspicion of wells poisoned by design, which has so often filled a whole community with an unspeakable and indefinable horror, finds an explanation here which relieves human nature of one of the darkest crimes ever charged to its account. The addition of one grain of sewage defilement to the gallon of water-supply was found, in the cholera epidemic of 1866 in London, to be directly connected with 71 per cent. of the whole mortality caused by the pestilence.

Geology turns over to sanitary science the conclusion that the drift-wells of Central and South-western Ohio are in all densely populated districts, in all cities, towns, villages, and hamlets, even those containing no more than a dozen houses, — *utterly unsafe for human use.* I have omitted all mention of contamination of water from adjacent graveyards and cemeteries. In the older countries of the world, this has been found to be a prolific source of evil, — and the danger, nay the certainty of such contamination, is leading many to advocate a return to cremation in place of modern burial. The farmer's well in a diluvial soil is not always safer than his city neighbor's; convenience leads him to locate it near the house and, adding to other

sources of danger, the barn-yard in many instances is close by. In default of any system of sewerage, all the water drawn from well or cistern for daily use, after being made the medium for carrying away the accumulations of wear and waste, which it is the business of good housekeeping to remove, including the animal matters dissolved from soiled clothing and left over from the various stages of the preparation of food, is thrown upon the surface of the filtering beds to feed the well. Evidently, the farmer's well will bear watching. *You* will not answer, as many do, that the fact that people have depended on such water-supply through the generations past, and that still the country is not depopulated, should allay our fears and reconcile us to the established ways of meeting our daily wants. If it were known that a well would carry infection and death to every one who drank of it, even the miserable suicide would pass it by and seek an easier way out of the world. But sanitary science seeks to guard us from the pestilence that walks in darkness and the destruction that wastes at noonday; it teaches us that, after all, fever and pestilence are enemies less to be dreaded than those insidious agencies that lower the tone and undermine the vitality and thus leave us to fall an easy prey to various forms of disease or to be carried away by some one of the periodical waves of mortality that sweeps through the land. It shows us how fallacious is the testimony of our senses on such points as these and would fain turn us over to the guidance of our rational faculties.

II. I must speak briefly of the water-supply derived from the bedded rocks of Ohio. The subject is an interesting one and worthy of a much more extended treatment than I can give it now.

With the geological scale of the State I will presume you to be familiar, and also with the approximate areas occupied by the different formations. It is to be borne in mind that the rocks themselves are obscured or deeply buried by diluvial beds in much the larger portion of the State. The water-supply through all such areas has already been considered, but in Southern Ohio, we have passed beyond the limits of the great Drift-Storm, and scattered through all of these central districts of the State, there are limited areas with such shallow coverings that the rock must be penetrated for the supply of water.

The discussion of the water-supply of the Blue Limestone of Ohio, — the lowest formation, geologically and geographically, in the State, — will be brief. The blue limestone has no water-supply of its own. Its composition, which consists of alternating beds of limestone and a fine-grained blue clay, very nearly impervious, forbids the entrance of surface-water to any considerable extent. A few small springs break out along its line of outcrop, but they are so heavily laden with salts of lime, magnesia, and iron as to be generally unfit for the use of man or beast. The blue limestone is overtopped by the "cliff limestone," a collective term for four great formations, the most important of which for our purposes is the "Niagara limestone." This formation has, in Ohio, the same structure as at the great cataract from which it derives its name. Its lower beds are impervious shales, and they are overlaid by a massive cap of limestone. The boundary line of

these divisions is a line of springs, and those who occupy the surface of this cap are sure of finding water by blasting or drilling to the level of the shales below. There are many limited areas (in the southern part of Clarke county, in the northern half of Greene, in Montgomery, Miami, and Preble) that belong to this division. The city of Springfield, the village of Yellow Springs, may be taken as representative localities. These drilled wells are generally deep and therefore furnish cold water, and the filtering has generally been efficiently enough performed to render the water clear, but it is, after all, liable to grave suspicions. The limestone cap, ten to fifty feet in thickness, which must be traversed before reaching the water-supply, is in the first place, very porous, and in the second place, it is everywhere divided by at least two great sets of joints which cut each other nearly at right angles. In other words, the cap is divided into a series of blocks, the edges of which, especially along the main planes of division, have been dissolved and worn by the action of surface-water so as to form crevices varying from an inch or two to a foot or two in width. These crevices, though generally filled with gravelly clay, still allow a very free transmission of all liquids entering from above. Indeed no more effective drain is required for all ordinary household waste than that which the surface of the limestone table furnishes. A sink descending to the limestone table through six or eight feet of overlying drift, will discharge for years, without clogging, all the sewage that a kitchen drain pours into it. It is easy to follow this descending sheet of sewage-water. It has not far to move in any direction over the surface of the limestone before it reaches a crevice or joint, into which it sinks as readily as if the crevice had been made for this office. It is deflected abruptly to the right or to the left to follow wider fissures as it descends and advances at once, and is thus merged with drainage from other localities, and at last is gathered into the common reservoir upon the surface of the shales, holding whatever it has been able to dissolve from the beds through which it has passed. Nay more, we must not forget that limestone is soluble, especially in the carbonated water that such sources supply, and all the phenomena of the springs of this region indicate that there are here true underground water-courses. No one can fail to see how gross and dangerous a connection can, in these ways, be established between the filth and corruption of the neglected surface, and the great sheet of water which the shales turn outwards. No one can fail to see that such a supply is never safe and that the evil day may come at any time when the typhoid, choleraic, or any excremental pollution shall find its way to the wells and be scattered as with explosive violence. We cannot forget that the most destructive visitations of cholera that have ever been suffered in this country, have been experienced in localities quite similar in geological structure to the limestone plain which we are now considering. The names of Sandusky, Nashville, Murfreesborough, Paris, Covington, and even of the romantic little village of Clifton, Kentucky, are all in this list. All of them agree in this particular. They are directly underlaid by a limestone cap, broken into regular blocks by two or more great planes of division.[1] Certain

[1] The Mineral Springs of Ohio, its Saratogas and Ballstons that are to be, will be found,

tainly it was not remarkable that in some of the towns that suffered from cholera, in 1873, the street pump of the defiled well became the most active agent in distributing the disease.

Do you ask, Where shall we look for a proper water supply? To wells and springs, certainly, I answer, where they are properly located, and above all, where they are properly guarded against doing the vicarious work of discharging sewage. Roof-water, gathered in properly constructed cisterns, and drawn for use by properly constructed apparatus, is always safe. Running water is almost always safe. Sir Walter Scott alludes to the old belief that the magician's spell is broken by the crossing of running water. Enchantment cannot dwell in a living stream. Running water, indeed, possesses as surprising a power as the breaking of a sorcerer's arts would be, — the power of self-purification. The sewage of a civilized town, — or if you can think of anything viler, the contents, for example, of the witches' caldron in Macbeth, — diluted with a score or two times its weight of water, and made to flow a dozen miles in the light and air, loses its baleful potency and becomes sweet and wholesome.[1] The Light and Air! These are the agents that work the wonderful transformation — mightiest of terrestrial forces, and yet the mildest. The group of questions to which this one belongs, and of which it forms so important a part, is now commanding the greatest attention of all the older portions of the civilized world. More and more is it coming to be seen that like the Sphinx's riddle, we must answer these questions truly, or give our lives as a forfeit. "Am I my brother's keeper?" asks the selfishness of man in every age. Sanitary Science answers, "*Yes!* YES! Unless you keep your brother, you cannot keep yourself. You may leave him to live and die like the brutes that perish, — in a worse condition even than they, — but no man, not even the loathsome beggar, liveth or dieth to himself. The pestilence which he breeds will come betwixt the wind and your nobility, and will smite you in your purple and fine linen." The responsibility is at our own doors. The curse, causeless, does not come. When a few years since the cholera was approaching the shores of England, the clergy besought Lord Palmerston, then at the head of the Government, to appoint a day of fasting and prayer, if so be God would be gracious and turn away his threatened wrath. The premier gave their piety a wholesome shock by advising them not to waste their strength in fasting, but to spend it in sanitary cleansing. The hard-headed old man was right, and the result showed that he knew more of the mind and the ways of the Lord in regard to cholera, than those who claimed to be His messengers.

if found at all, along the outcrop of the *Huron Shales*, a formation that stretches from the mouth of the Scioto River, northward across the State. The rocks of this division yield throughout their whole extent, to the water that slowly filters through them, sulphur in large quantity, iron, silica, soda, and lime. There are already many springs in this belt of local or even more than local reputation. The White Sulphur Springs of Delaware county, and the Mineral Springs of Adams county, may be named as representatives of a large class. It will be well if the water from the Black Slate proves to have medicinal properties, for in all other respects, certainly, the formation fails as a water-bearer. The supply is small in quantity and execrable in quality.

[1] It is not certain that foul sewage can be made wholesome, however clear it may become by filtering in the earth or by being oxidized in the river. — [EDITOR.]

"We have fallen upon evil days." When the pestilence smote the camp of the Greeks, "far on the ringing plains of windy Troy," not a man of them all, save at least the haughty Agamemnon, need deem himself at fault. It was the silver bow of Apollo that wrought the evil. And through all of the Christian ages, even down to our own day, it is the hand of God to which we have charged all like visitations of disease. But Apollo is dead, and God forbids us any longer to misinterpret His providence; and we, alas, must bear our own burdens, and for a multitude of our sicknesses at least, must accept the humiliating explanations which are furnished by our ignorance, our self-indulgence, and our laziness.

BUILDING GROUND IN ITS RELATIONS TO HEALTH.

By EZRA M. HUNT, M. D., *New Jersey*.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 11, 1874.

THE condition of the ground has very much to do with all questions of health. The character of the soil, the degree to which it can dispose of all that comes in contact with it, — whether in the form of gases, of animal or vegetable decay, of pure and impure liquids, — all have intrinsic and vital bearings upon human health. The making of the earth a place fit for the healthful habitation of man, is a part of the problem which creative skill has considered. We need to become aware of the constant activities and adjustments taking place to this end. These are not accidental or incidental, but involved, as if the chief things intended to be conserved. Where natural transformations are in nowise interfered with by art, it is wonderful to see how processes involving productions inimical to health are so conducted as to be entirely consistent with vigorous existence. While decomposition is the rule, evil therefrom under natural conditions is the exception. While, for instance, enough carbonic acid is produced each day to kill all the inhabitants of the earth, yet it is so well managed as not to interfere with the health of man or animal.

But the very moment a spot comes to be builded upon, it is by necessity placed in abnormal conditions. The building clears the ground of that herbage which had no unimportant sanitary office in appropriating the products of decay. It covers it from sunlight and sun-heat, and necessarily makes its condition as to moisture quite different. It interferes with the range of winds, and modifies the immediate thermometric and hygrometric conditions of the atmosphere. It throws the rain-fall into streams upon the ground around its sides, instead of allowing it to diffuse itself in drops. In winter it causes accumulations of snow and ice. It alters the course of water, making, it may be, the cellar, the well, the cistern, the cesspool, the privy vault, and the sewer, parts of its underground drainage. In a word, it alters the whole relation of the ground occupied and of its immediate surroundings. Besides all this, the necessities of habitation create filth, garbage and dust, and refuse of various kinds, which are conveniently added to the soil just where it cannot use them.

Pettenkofer says of the city of Munich, that about ninety per cent. of its excretions go into the ground. It is thus easy to see the varied conditions interposed by human dwelling-places, and how these conditions are magnified by the multiplication of buildings and the crowding of inmates. The great sanitation of nature is suspended, and factors of insalubrity introduced to a degree that arrests our most careful attention. If cities are ulcers on

the body politic, they are not less anti-health combinations against the body physical. It is no small or unimportant thing to have removed the grass that sucks up the miasm, shaded the ground from sunlight, changed the laws of its moisture, altered its water-courses, and interfered directly with the forces which elaborated health. It is as easy to make destructive sanitary changes as to make destructive physical or chemical changes. The one or the other may depend upon only slight variations of atomic proportions. In chemistry, the equivalents of calomel and corrosive sublimate differ but little ; so a single interrupted change may determine whether we shall have prophylactic or destructive agencies.

Cotton wool and glycerine are very harmless substances ; but a slight chemical variation, in which no important change has taken place in outward aspect, makes of the one gun-cotton, and of the other nitro-glycerine. The change is so little, and the deadliness so great, that chemistry itself stands in wonder and speaks of their fatality as accidental, and calls them "substitution products." We know not but that similar derangements in nature's methods of disposing of the products of decay in the ground make those fortuitous combinations which we call choleraic or zymotic, and cause these to break forth into the fearful explosions of fatal disease. Changes thus actually made are interruptions to the equilibrium and compensations which nature has established, and as such are fraught with danger to human health.

Consider what a complex thing the ground is. — We are so apt to look upon it as a mere succession of strata to hold us up, that we forget its complicated structure. It has in it not mere mineralogy, but it is made of fire and air and water as well as earth. The sun causes in the earth a diurnal wave of heat in our climate of about four feet in depth, varied somewhat by soils and seasons. As this recedes by night, there is circulation of heat beneath the surface ; the line of uniformity of temperature is from fifty-seven to ninety-nine feet below the surface (Forbes). This one fact shows the range of heat which circulates above the earth. When the sunshine strikes upon it, it acquires a much higher temperature than the surrounding air. The difference is sometimes so great as to make near the ground, on a very hot day, a refraction sufficient to cause indistinctness. When we remember how much moisture and evaporation depend upon relative temperature, and how much all these bear on health, we get some idea of the hygienic condition of the ground. The house may stand over it, the pavement may cover it, and stone and concrete seem to make it a basis for travel ; but from it is evolving an influence on temperature, which penetrates and affects all the animals that dwell upon it. Since the warmth of the earth, radiating and being extracted at night into the colder atmosphere, causes the dew, this is but one of the registers of the relation between the ground and the air above. The heat and moisture of the ground, and the temperature of atmosphere above it, are unavoidably relative; and it is just as sensible to talk of changing ground, as of changing air for health. "In the interior of substances, as well as in air, a stream of radiant heat is constantly passing and repassing in all directions." Heat, as a form of motion, has its ac-

tivities in the earth as well as above it. Temperature affects chemical affinity, and so has to do with combinations and decompositions. As many decaying substances have little chemical stability, mephitic gases are easily produced. "Even the laws of gaseous radiation have," as Balfour Stewart expresses it, "lately become of great practical importance."

A city interferes with the constant effort of heat after equilibrium of temperature, as recognized in the theory of exchanges. The whole subject of thermo-dynamics has intimate relation to the ground.

Besides, its temperature has to do with thermo-electric inversion and with electric conductivity. So marked is the influence of the ground that meteorological investigations keep clear of the surface. The British Association has a committee on underground temperature. When we come to see the abnormal condition in which the ground is placed in regard to heat, and remember its indispensable office in dealing with air and water beneath the surface, we cannot but come to feel still more the sanitary significance of the study. Indeed medical men need to remember that earth sanitation has to do with great questions of physical science, and so is a department of physics to be studied technically as such.

Next, the ground is largely made up of air. We are familiar with the fact that into a pail of soil we may pour part of a pail of water and yet not have an overflow. But we forget that all this space between particles of soil when not displaced by water in the ground is occupied by underground atmosphere.

Not only do loose soils contain air, but all the softer rocks and the frozen ground. An animal will keep alive for days in a space surrounded on all sides by what we call air-tight ground, by reason of the air it obtains from the ground itself. You may compact it with heavy rollers, but still that invisible spirit of air is running hither and thither, beside each particle, never meant to be stagnant but doing great sanitary work. In its circulation it is meant to oxidize and hydrocarbonate animal and vegetable decay, so as to make it innocuous, and great volumes of carbonic acid are handed over to vegetable life.

The requirements for ventilation are not all above-ground. — It is in constant interchange with the surface air, or else confined and fouled in its impeded underground circulation. Bad air stagnated in the ground is hurtful in all that constitutes insalubrity by interfering with normal and healthful affinities. Even the rain, as it passes through the atmosphere, becomes aërated and carries into the soil more oxygen than air itself to oxidize organic matter, if only the spaces are not already filled with stagnant water or foul air.

It is believed that one of the causes of the prevalence of such fevers as typhus and typhoid in the winter, is that the great inner heat of houses causes the currents of air from the surrounding ground to set toward them, under the general law of currents as affected by heat. So the basement and the house suck up the ground air contaminated by its wrong conditions, and the local heat causes it to penetrate more than in the summer. Gas and the air of cesspools have thus been perceptible in houses not supplied with them, and where the situation was not near. Often in cities foul gases, in-

stead of being consumed, are discharged by pipes into sewers and underground connections. This may relieve the atmosphere from the nauseous outgush, but too often sends them to mingle with the underground air, to be discharged in diluted but nevertheless harmful quantities into the houses.

If the soil-air is polluted by sewage, or only by the interruption of those processes which nature has instituted for purifying it, we are sharers in that contaminated air. There are some systems of ventilation which actually serve to draw in, not only cellar but polluted ground-air, and send it circulating through our houses. If bed-ridden sickness is not caused, there is yet that lowering of vital vigor which makes invalidity. The want of tone of system of which those complain who are confined to houses, is often in part owing to the impure ground-air which finds its way into their breathing atmosphere.

It is but recently that attention has been drawn to the fact that carbonic acid may be rapidly produced in such a way in the ground, where the natural ability of the soil to dispose of it has been superseded, as to cause it to be suddenly imparted in large quantities to the upper air.

On this whole subject of ground ventilation we have much yet to learn. The drain-pipe is not only useful to rid the ground of surplus water, but also as an artery for air. It has pneumatic as well as aquatic importance. Nay more; in closely compacted cities a system of underground pneumatic tubing would greatly aid the purity of soil, and help to compensate for some of the interference with heat and air which a city interposes. Air is the great disinfectant, and its freer circulation underneath cities needs to be secured upon a plan. Both the drying and the cleansing of the soil depend upon this as upon no other agency.

The fact of water in the ground is more apparent than that of air, but still its relations thereto are underrated in its sanitary bearings. There is a depth varying with soil and locality at which the ground-water is in general intended to fill up the spaces between earth particles. But in several feet of the ground nearest to the surface it is intended that the soil should have both air and water in circulation. Between these and heat there is a correlation and conservation which is conducted as wonderfully and as scientifically below ground as above it. The surface, like the human skin, is but the plane of contact, while within is incessant motion. This condition of relations is necessary for the carrying forward of changes which, when uninterrupted, tend healthward, but which, when suspended, contaminate the ground. There is a vis medicatrix naturæ in the earth as well as in man which is dependent upon the uninterrupted play of natural forces. The effect of stagnant water is to cause the decomposed vegetable and animal matter in the soil to accumulate. This is illustrated by the fact that the occurrence of stagnant water is necessary to the production of peat. Organic, and especially agricultural chemistry, is tracing these changes in their wonderful adaptations to growth. The conditions of temperature of air, and of liquids, are self-regulating to a surprising degree where art does not intervene. But to this end there must be air and heat and water-circulation. Even those myriad organisms from bacteria upward, which science is reveal-

ing, are instituted methods for disposing of organic material, but it is only amid the activities of air and water circulation that their existence occurs. The capacity of the ground for air is already shown, and by expelling the air from dried earth, or in other words, by pouring into it water, we find its capacity for water. Such ground as we are familiar with, will thus take in fifty per cent. in volume of water, and even marble will hold four per cent.

That which we call dry ground has still much moisture in it. When we are treating of the ground we have, therefore, intimately to do with vital questions as to water. Says Moreau Morris, recently sanitary superintendent of New York City: "Medical and sanitary science and experience forbid the erection of dwellings upon an undrained soil. Heat and capillary attraction bring to the surface that moisture and dampness which should have been removed by sanitary engineering. The result is malarial fevers, consumption, suffering, and death as punishments for neglecting applications afforded by the light of science."

It is not enough in building a city to preserve in full all natural water-courses. Even the perfection of field-drainage will not suffice. You are about permanently to cover the ground, so as to add to its dampness, and in various ways interfere with its natural changes. The readiest and most indispensable way of compensating for radical alterations you are making, is by the multiplication of underground tubes. I know not but that ere long, with the precision of a mathematical result, we shall be able to state how much sunlight, sun-heat, radiation, evaporation, etc., we have shut out in a solid square of buildings, and how many square feet of new pathway underground is required in compensation.

But heat and air and water, as they circulate beneath us, and form parts of the ground, are not only important in themselves, but they enable the organic and inorganic substances of the ground to undergo their disintegrations and reparations.

The water is the menstruum circulating through the soil by which vital or destructive changes are carried on.

So air and heat are lending their aid, and the earth itself using them as instruments, has its own constituent particles in process of change.

All these are wonderful when studied in their conservative sanitary tendencies, and wonderful also in the evil which may result from interrupted processes.

Grandly and gloriously does nature provide for all that relates to this underground world as to its organic and inorganic material, its air, its heat, its water, its animal life, so far as health is concerned, if only its surface, and the world above are left to the uninterrupted play of natural provisions. It gives off its superfluous carbonic acid to plants, or stores away its heat for fuel. Field and forest, air and sky, are in happy correspondence. The culture of the earth is itself in the direction of natural appropriation, and so when rightly conducted aids the healthful activities of nature. Ground, then, is not a mere passive stone-like thing. We need to know that in a hygienic point of view it is only by the working of manifold chemistries and philosophies carried on and out, by definite plans, that it makes itself habitable and

healthful. It is a foundation made up of fire and air and earth and water and inner life, the salubrious condition of which is dependent on its being left to the uninterrupted play of those forces by which heat and air enter it with unimpeded facility, by which water has easy access and uninterrupted outflow.

And now in bold contrast we must recur to the fact that a habitation or city is an artificial construction which in its chiefest characteristics interferes with all these natural conditions of ground. It is the interposing of a great separation between the forces above and beneath. It cannot suspend relations, but it can and does fearfully complicate them. It interposes hazardous hindrances or limitations to changes which are hygienically necessary. The ground, when it evolves unhealthy decompositions, also evolves its enormous vegetation to dispose of them. The city does not prevent the decomposition, but does away with the natural process of disposing of it.

The ground, when by its trees or herbage it shuts out sun-heat, has its millions of leaves to absorb noxious material, and even uses its woods and its herbage to regulate temperature. The city has no full compensation. It has also its natural well-distributed rain-fall and water-courses. The city quite deranges all these. We need, by careful thought over that which goes on in the natural ground, and its indispensable relations to health, to recognize what an unwholesome fact a city is. But besides complicating interruptions it adds enormously to the sources of contamination. It creates occasion for the manifolding of natural conditions and processes, and then suspends them. Weigh with large scales, in full and fair estimate, what is done and is needed to be done in the unbuilded earth by the forces of nature, and how far a house, and towns, and cities interpose hindrances. Weigh with larger scales the immense factors of sanitary evil in all the excretions incident to living, so much of which falls to the ground.

The more we investigate the more we come to know the enormity of the contrasts and interferences which the building of houses introduces. Wherever we thus mass men, art has interposed unsanitary conditions which art must rectify. Having informed ourselves of the nature of the ground, and what in its natural state it does to elaborate health, we must see how far we can abate the evil of the circumstances we have necessarily introduced. How far can we restore natural conditions by artificial appliances?

As we furnish new sources of evil in new vegetable decompositions, animal excretions, garbage, sewage, dirt, foul gases, and filth in manifold forms, how shall we reduce all these to their minimum and best provide for their removal?

With these cardinal facts as to the ground in its natural state, and with an appreciation of the complicating circumstances introduced, we go first of all to the sanitary engineer and ask what is the state of the ground under our buildings as to its air, its moisture, its heat, its proportions of decayed or decayable matter? If too much water, how best shall we draw it off, and so give access to air to correct dampness and foulness? The basements and the sub-cellars must be closely questioned. Which is the better, a house without cellar or basement, located on a water-soaked soil, or one whose

cellar is nearly full of water, but with room for a stratum of ventilated air between?

Is it not best to secure the water-supply for other than drinking purposes from local wells in order to aid in the drying of the soil? What is the best system of drainage? How far can we thus aid or restore and supplement natural conditions, and by giving air and heat free entrance, enable the ground to dispose of its matter in a healthful way? Where dampness exists, how much can be done by cemented floors and sides below ground? How much good or ill by artificial heat? How shall sewage be conducted through ground so as not to contaminate it, and water so as not to add to dampness? Shall the streets or yards be protected by pavement, or covered with trees, grass, and foliage so far as possible? What evils arise from city dust, and how far is street sprinkling advisable? Shall intra-mural interments be allowed at all?

How shall width and direction of streets, and heights of buildings, and proximity of rear buildings, be best regulated to secure needed sunshine? How shall structures be painted so as to favor a healthy temperature? How shall streets be paved so as least to interfere with right changes in the ground? In repairing pavements, should any absorbent or disinfectant be used? How shall the water from buildings and the general rain-fall be best disposed of? How shall garbage and all animal excreta be kept out of the ground, since foul ground-air will foul the atmosphere? How shall miasm — mother of fevers springing from the ground, and at home now in cities — be detected and prevented? — for it, too, is a subtle result of unnatural combination. What are the relations of drainage, sewerage, and all under tubing? May not all cities study the laws of "pipe-laying" above ground less, and below ground more, with advantage? These, and such as these, are among the manifold vital questions which sanitary science has to ask in reference to the ground. The great problem in every habitation, and especially in every city, is to make up for the evils which dwelling in ceiled houses entails, and by compensatory methods to place the soil in as good condition for health as it would be if not thus occupied.

In inspecting the unhealthy locality about Second Avenue and Seventy-sixth Street, New York, although the ground had been raised, a cause for a uniformly excessive death-rate was found in the obstruction of a natural water-course, and the substitution of drains and sewers at too high a level.

In another case, sickness in a fine row of buildings was found to depend upon the fact that the underground received the foul drainage of two or three squares. It is easy for one part of a city, or even for the sub-cellar of one or more houses, to become the cesspool for a neighborhood, by some little error or circumstance that turns the outfall in that direction. We are constantly finding out, more and more, how much sickness depends upon invisible ground conditions which the sanitary engineer must remedy, or which the city fathers above ground must prevent, if they desire to keep themselves or their children out of it. Whole groups of zymotic diseases are traceable to ground conditions. Rheumatism and all pulmonary affec-

tions are vastly dependent upon ground moisture. Foul air, foul water, and foul decompositions come from the ground, and must be attended to in the ground, and also prevented from getting there. There is a climatology of the ground as well as of the atmosphere, and air, rain, and temperature are its great regulators.

Although a city is a complex problem in a sanitary way, it is solvable. Science is not as far behind as is the municipality in its application. With the ground, especially, we know what to do, if only the command was given.

Many an experiment is now full-fledged experience; and we can say we know. We must look down as well as up and around. If these foundations are polluted, in vain we work on the surface and in upper air. A proper ground-base is what we want for human habitations more than any sanitary want of the age. If to-day our Association, instead of walking amid the beautiful streets of the cleanest of American cities, could take their promenade for sanitary service between the sub-soil and the surface soil, wonderful revelations would be opened up to our view. There would be found deposits of filth where least suspected, defective sewers, soil overladen with decompositions, stagnant water and stagnant air, connections between cesspools and sink-wells and houses where now unknown; stenches more varied than Coleridge found in the city of Cologne, and unsanitary conditions enough to alarm and awaken the inhabitants that people the surface.

Could we at one lift take up four feet depth of city soil, with its undue moisture, its overladen decomposition, its unfriendly germinations, and all its altered conditions due to its city covering, and compare it with an equal surface upon some elevated plane in the open country, we would at once detect causes quite sufficient to account for manifold differences in sickness and mortality. Independent of the interruption of natural purifying forces which a city introduces, could we get together the amount of filth which, in one way or another, — solid, liquid, or aëriform — finds its way into city ground, we would be shocked at the enormous tonnage. We would not wonder that chemists and sanitarians have come to speak of some soils as zymotic, and others as "typhoid, ripe."

Within forty miles of this place is a city of twenty-five thousand inhabitants, as to which reliable reports made to me, say: "It has no system of sewerage. Garbage is thrown into back alleys, or in rear of lots, to take care of itself. House-closets are drained into cesspools and ground near the buildings. The solid contents of privy vaults are removed at long intervals, and the liquid portions soak into the soil. The Board of Health has held no meetings for a long time, generally awaiting some great nuisance, or the actual invasion of an epidemic. It has no system of vital statistics, no certificates of causes of death, and so no actual record as to its insalubrity. All that we know of it is, that it is a good place for medical practitioners, and that they recognize a ground condition in many parts which is most deplorable." Large cities are not the only ones which suffer. We can find in country towns and villages, ground which any New York inspector would report a nuisance. Damp ground, wet cellars, decaying vegetables, garbage,

well and cesspool and privy too near each other, occur in many small places. We are aware that soil itself, when it has a chance to act on the dry-earth system, will, where not subjected to constant and excessive contamination, purify itself to some degree; but yet, from wrong conditions about the ground of houses, about the drinking water as affected thereby, we see many evil results. To preserve porosity to ground beneath and near dwellings, is among the most important of sanitary efforts. This merely means to give air free access to soil by preventing stagnant water. The indispensable disinfectant below ground as well as above, is air, the circulation of which in the soil depends upon temperature, and this on light and heat as applied to the surface. The carbon is provided for vegetable life and other purposes, but when we come to deprive the soil of plants and substitute animals, we cause it to be unappropriated by the one, or harmfully appropriated by the other. Where, as in some parts, made soils are composed of an over accumulation of decaying matters, or of foul material removed from streets, the building of houses over it may conceal, but cannot destroy the contamination. More or less of the foul air must find its way out of the soil and endanger the health of those living upon it. Some claim that concrete and cement and stone shut up the soil so as to prevent or moderate the evil, but experiments show that air and moisture still continue their interchange. While coarser filth can be more easily gathered from such a surface, and flushing and cleansing more easily conducted, the air of the soil beneath still has active relations to the atmosphere above. By this perpetual motion of air and water in soil, and by the laws of diffusion and capillary attraction, nature is busy maintaining an equilibrium of healthful compensations, which is embarrassed by human tenements, but fortunately not altogether suspended.

There is indeed need that each dwelling and building be recognized as of itself instituting some unsanitary relationship in the soil about, and as such it is subject to treatment.

As all our smaller cities and towns depend on local wells for water-supply, foul ground involves foul drinking water, and so the necessities of a clean soil are still further magnified.

We have thus sought to make prominent a consideration of ground as related to dwellings, and to attract attention to the interruptions of natural laws conservative of health which they interpose, and to the additional contamination with which they afflict the soil. Having found out how important for health it is that these ground changes should go on, and that soil and air and heat and water should have their proper relations, we are better prepared to seek how to reduce this interference to its minimum or to compensate for it by other methods.

Having found what a serious thing it is to add bad material from above to ground whose purifying power we have already embarrassed by structures of art, we can all the more feel how diligent we must be in preventing the debris of human dwellings to add to the evil.

The engineer, the chemist, the microscopist, the physician, the architect, the sanitarian, have already been able to establish facts and record the

needs, and sanitary legislation has much to do in reducing the results to practice. If we have increased the ground water by covering it from heat and light, we must, by special drainage and outflow, give greater facilities for its subsidence. If we have shut out the air, we must thus make room for it, and keep the ground-air pure both by circulation and by not multiplying materials for decay.

Having interfered with some of the natural ability of soil to dispose of decomposition, we must not overspread it as if we were top-dressing a meadow or enriching a wheat-field. With intelligent recognition of the facilities of self-correction and health equilibrium which we have embarrassed by our buildings and pavements, we must by art compensate therefor, and as far as possible prevent all abnormal conditions. Every advance in sanitary science is showing how much disease is the penalty of transgression of nature's laws, and how much of the penalty accrues from wrong telluric conditions. The voice of spilled lives cries from the ground. We want more of a dry-earth system beneath and around our dwellings, more of pure circulating air in the underground flow, more of an uncontaminated surface-soil. The air we breathe, the aliments we take, the clothes we wear, the ground we live on, — these are the sanitary corner-stones of upbuilding life. Not the least is a ground whose earth, and air, and heat, and moisture, and cleanliness, fit it for the tread of the great masses of population.

Perfect under-drainage under the definite skill of engineers, is the first great need of most cities. Regulation of cellars and of all other holes below the surface, is the next great study. It would be found that the mere filling up of a cavity does not dry it, and that drains under ground will not carry water or refuse up hill any better than they do on the surface. The proper airing of all substructure, because of its proximity to ground, comes in next for consideration.

What we can do to sweeten or purify surface soil already fouled, is another point.

Then the great question of what to do with all refuse so as to keep it out of city soil, is the large and momentous subject which must ever present itself to our attention. Surely in the unnatural state in which building itself has placed it, it has enough to do without adding one iota of this burden.

Enough if we feel the momentous interests involved in ground purity. Enough if we can arouse each other to a closer study of these fundamental and vital interests, and at the same time convince the citizen and move municipal authorities to more careful thought and more intelligent action. We must get the homes of the people on better foundation than damp, water-soaked, air-polluted, filth-burdened ground. While at work upon the surface, abating all influences inimical to health, we must not let the covered earth, because concealed by dwellings, escape our searching ken. We must see to it that its soil-particles are not overladen with vegetable or animal decay, that its fountains of moisture are not impeded in their flow, or saturated with impurities, that air has free circulation through all its spaces, that its regulative ability, as to temperature, is not unduly complicated. Thus starting with a healthy and a health-imparting ground, we are on a right basis,

and are prepared to upbuild as on good foundations that grand system of sanitary science whose object is the prolonging of life, the preservation of health, and the conservation of human happiness.

DWELLING-HOUSES IN THEIR RELATIONS TO HEALTH.

BY EZRA M. HUNT, M. D.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 9, 1875.

HOUSE construction involves more as regards the status of public health than any other one thing in the sphere of sanitation. In the construction of the modern dwelling-house, taste and convenience, however important, should be subsidiary to sanitary considerations. The true function of a dwelling is to assist rather than to supersede nature; where it is made, as it too often is, to exclude air, sunlight, and a certain degree of moisture, it attempts too much. The right philosophy is to dwell within it, as we do within our garments, and thereby seek to regulate temperature and to protect from extreme exposure. The popular idea upon the subject is quite different. Circulation, temperature, and the laws of insensible moisture are habitually hampered to such a degree that alternate dryness and dampness are too often the only atmospherical condition of the interior. Bad as is the tenement-house of our overcrowded cities, there are faults in the building of our brown-stone fronts that are equally as erroneous. In every instance, the locality, the foundations, the immediate surroundings, the material, the mode of construction, the size of apartments, the arrangements for all culinary and laundry purposes, provisions for air, water, heat, offal, and manifold other points, demand our consideration. All other ideas are merely accessory to the one prominent problem of making the house the best possible apparatus for elaborating health. Let us follow the building as it rises, and consider how it can best be adapted to the welfare of its inhabitants.

Foundations. — The first part to be considered is the foundation. The act of building necessarily disarranges the normal conditions of light, heat, and natural ventilation, and there must be compensation. This disturbance causes undue moisture and interrupted circulation, and must be provided for. The means generally adopted is to place a cellar under the house. This is all very well, but unless the surrounding soil is well drained, we have made a reservoir or a hole for collecting and condensing damp! It is of itself so much of a terminal drain that in the country the row of trees nearest to it will grow faster than the others. If it is to be used or inhabited, we should not make it the dependency for drainage. In digging a cellar or forming a basement, care should be taken that the ground in the vicinity be well drained. A disregard of this important essential leads, as is shown by the sanitary statistics of New York and other great cities, to the most fatal results. Drains should be arranged under the building, out-

side, and around the walls, in sufficient number and calibre and fall to dry soil unnaturally shaded, and to counteract the additional moisture which occupancy entails upon it. As air, in the ground as well as out of it, is the medium of evaporation or the chief regulator of heat and moisture, series of air-tubes or pneumatic pipes, so elevated and protected in their outer openings as to admit nothing but air, have been found to be powerful adjuncts in securing greater circulation and dryness.

Under-ground Walls. — The walls of a sub-cellar or basement should theoretically be porous throughout, but as this presupposes a degree of exterior drainage, which is too often wanting, the plan commonly adopted is to build the basement wall as solid and impervious as possible, in order to keep back the flow of water from the outside. Masonry to answer this requisite must be of thickness in proportion to outside soakage, and be concreted and grouted with the most impenetrable cement. Sometimes a double wall is made with a space between, connected with the outer air. This arrangement will answer if the outside of the outer wall is so impervious as to exclude water. Another plan is to fill the space with vitrified thin brick, the porosity of the latter affording space for air, while an extra septum is formed by the glazed surface. The ground of the basement should be concreted in the same manner and for the same purpose. Our chief dependence for dryness and ventilation is to have the floor raised from the concrete bottom so as to allow air circulation from the outside by air-boxes or tubes beneath and wainscoting or furred-off walls on the sides, giving space for such extra introduction of air or sunlight from the top or lid of the box as will compensate for its exclusion at the sides. Care is also taken that, at the adjacent parts where these apertures occur, no surplus water falls from roof or outside, and that surface-wet be carried off by flagging and grading inclining from the house. As by the laws of absorption and capillary attraction the moisture in the ground wall will rise above the ground level, the same kind of wall is usually carried to the height of the basement. Basement windows should be capacious, and reach nearly to the ceiling, and be capable of being either raised or lowered. There should seldom be less than eight feet in the clear between the floor and ceiling of the basement, and at least half of this space should be above the ground level. Kiln-dried and close-jointed wood is the best material for the floor of this portion of the house. Especial care should be taken that the inside walls be so constructed as to compensate for impervious outside walls and so aid in securing evaporation and dryness. In a sanitary point of view, the chief requisite for these walls is such compactness yet porosity as prevents moisture and sufficient smoothness to avoid catching and fastening dust or light floating material. The usual lime and hair-mortar with lime and sand-putty covering, or stucco, is probably the best for inner walls. The hair at present furnished is sometimes so laden with organic matter as to call for the adoption of some substitute. When medical records show that hospital walls have furnished over forty per cent. of organic matter, it is well to be careful upon this point. If we depend upon hard walls, they should either be painted or so smooth as to admit of washing. In this way they are less apt to retain floating par-

ticles, and are more easily cleansed by dry or moist rubbing. Investigation shows that the kalsomined wall, while temporarily of a somewhat cleansing or disinfecting nature, is not so cleanly as it has been reputed to be. The cases in the New York and Paris hospitals in which improperly constructed walls have been the receptacles of contagion, are well known, and in some instances it has been found necessary to destroy even the whole wall because it was thus impregnated.

Papering. — Papering has of late years become so much a part of construction that its sanitary bearing must not be overlooked. One who has been in some shut-up parlor of an old house papered with flour paste through half a century, with old paper imperfectly removed each time, and the whole cemented by mould and dampness, will not wonder that good health does not abound in such country homes. The facts in such a paper as that of Dr. Draper (Mass. Health Rep. 1872), or of Professor Kedzie (Mich. Rep. 1873), illustrate as shown by arsenical poisoning how particles of paper may mingle with the dust of the room and produce serious effects. Sizing made of animal matters is used in most paper. The "flock" or velvety paper is made of material similar to "shoddy," and besides its own dust in the wearing off, is an adhering surface. Glazed and varnished papers are less objectionable.

Cross Partitions. — Cross partitions constitute another evil which needs rectifying. In frequent cases these partitions are so extended across the house and closets, and dark rooms so interposed as to prevent circulation of air from front to rear. Ventilation requires that a certain steady movement of air to and fro be kept up. It need not necessarily move fast. Experiments show that it has to reach a maximum of between nineteen and twenty inches per second before becoming apparent to our senses. Between this and stagnation there are many gradations. Mere diffusion in close apartments is but an intermingling of foul gases, unless there is additional activity of motion. A stir-about of impure air does not of itself give purity. It must be still further displaced and diluted by draughts, or by insensible circulation. Many a house, by reason of its construction, has its spots of stagnant air, or, as they have been called, "dead ends," of foul air. The present plan, which intercepts the passage of air from outside to outside by two impervious walls, and then interposes double walls with closets between, is wholly objectionable. In each middle wall there should be transom windows opposite each other or over the doors, with pulley and cord inside to secure their opening. In too many houses the basement hall, which should be one of the best and most thoroughly ventilated in the building, is the darkest, closest, and dampest in the whole house. Few householders appreciate how much of their supply of air comes up from the basement, by the hall, dumb-waiters, and the ceiling. It is for this reason that the greatest pains in construction should be taken here. The front and rear doors should always be provided with transom windows above, and part of the door itself should be constructed of glass, protected by iron bars. Similar modifications are necessary in the structure of the outside steps and back portico. The area beneath the front entrance should always have

netted iron work or movable rise-boards. Another essential requisite is an open fireplace in each large room of the basement, an arrangement by which additional ventilation is afforded. In general, we claim for basements what Woodward claims for hospitals, "No ward should be without an open grate, no matter what other mode of heating is adopted." All these precautions are necessary in the construction of the basement, because it is so much more than is commonly realized the distributing reservoir to the rest of the building. It should be the rule in every basement, and indeed in all parts of the house, that all closets, under-stair recesses, sinks, cupboards, and clothes-closets have no inaccessible parts and have some provision for ventilation. Cozy corners should not be fitted up for hiding dust and foulness. Laundry closets under stationary tubs are poor places to store soiled clothing, away from air and amid dampness. We should avoid dark corners in houses as sedulously as we would sharp ones in stocks. The basement cannot be shut off from the rest of the house. By reason of its location and the domestic purposes to which it is devoted, it needs especial guarding against all air pollution. Now that the hot-air furnace is located there it is easy to distribute this air through every part of the house. Germs of contagion, which might otherwise be dormant, are by the one process warmed into activity and distributed into every apartment. A basement with foul air from any cause is thus easily made a Pandora's box with impervious bottom and sides, and motive power within, thus all the more fearfully available for ill-health to those who dwell above it.

Inclosure. — Let us next consider the building above the basement. In the composition of the outside walls, the great desideratum is to secure building-material that air may freely permeate, and thus keep the inmates drier and warmer, and yet not so porous as to allow perceptible outer currents of air to flow through it. Builders as a rule aim to make air-tight houses, but usually and fortunately for the public fail in doing so. When, by the use of the densest granite and the closely-fitting iron slag, they succeed in accomplishing their object, no amount of inside shafts or heaters or window ventilation can make the structure fit to live in. The various substances in common use for building purposes are valuable just as they contain sufficient compactness and firmness, and at the same time secure a sufficient atomized air circulation, without unduly absorbing moisture. The densest granites and marbles will contain about a pint of water in each cubic yard, and so, when dry, admit a similar proportion of air. Ordinary sandstone will hold one gallon to the cubic foot, and so on. It is because of sufficient compactness yet porousness that bricks are so well adapted to building purposes. Yet these differ much as to material, and porosity. Their general adaptability and quality need to be tested. Walls made of bricks of greater porosity in the inner courses we have found advantageous as regulating evaporation. The unburnt bricks of which adobe houses are constructed, if well dried, answer a good purpose in warm climates. In building, something depends on exposure, on size of blocks, and upon thickness of walls. Where walls are exposed to beating rains, a smooth or glazed surface does better than a rough one. Much depends on the ma-

terial and make of the mortar. The great value of our mortar and cements is in the fact that the hydrate of lime formed, gradually changes into a dry carbonate, compact and porous to air; with sharp sea-sand it forms a siliceous limestone. It provides manifold surfaces amid which water is readily replaced by air. These qualities are just what are needed in building material. As it forms about one fifth of the inclosing structure and the chief material of inside walls, its quality, proportions, and preparation are all important. The lime and sand inside wall-finish on dry ceiling lath, not less than one fourth of an inch apart, helps the progressive porosity of the structure from without inward. This should extend behind wainscot and baseboards. It is even better if the heavy coat of plaster extends along the floor beams, so as to make a continuous inside wall from basement to attic. Where wood inclosure is used, a similar result is gained by the use of sheathing, tarred paper, and overlapping clapboards, oiled or painted. The inside studding, the inlaid brick, the furring and finish of walls, are valuable just in proportion as they secure exclusion of wet and current and such permeation of air as promotes dryness and equability of temperature. The preference to be given to this or that material or combination may depend on soil, locality, climate, exposure, degree of occupancy, and various modifying contingencies, but in all cases the principle involved must be kept in view. Thus will we secure the Q. E. D. which is to build such a house as will in its construction best conserve the health of the inmates. Fortunately, durability and architectural tastefulness are compatible with this. But all must be kept in severe symmetry with the prevalent idea of hygienic utility.

Superstructure. — What we have thus far said as to basement and inclosure includes much that would otherwise need to be said as to the consecutive stories of the building. The parlor, and other rooms of the first floor, need similar care as to construction and arrangement. Height of ceilings has to do with air space, and so is governed much by intentional degree of occupancy. The adornments of cornice, centre-piece, and windows, are so adapted to catch floating material, and are so difficult of cleansing, that they must not be too ornate. If used as apertures for ventilation, this helps to clear them of dust. Panelled walls and harmless frescoes may often take the place of raised or carved work. Close-fitting base-board, with quarter-round moulding, or some other simple design, is preferable to those with manifold crevices. The windows should reach high toward the ceiling, and sash, sill, and surroundings should be plain. Window sashes need, of course, to lower as well as raise. The slight opening thus afforded above and below secures far better ventilation than a mere lowering from the top. Shades, or outside blinds, worked by turn-screw from within, are better than inside shutters. Inaccessible recesses, like those for sliding-doors, are too often places for harmful accumulations; and where the hall does not extend from front to rear, it is too often illy lighted and aired, and the transom sash above the doors is required.

The next story is chiefly the place of bedrooms, clothes-closets, and other convenient cubby-holes. With bedrooms at each end of entry, and closets between the chief rooms, good airing is much obstructed. Soiled articles

find their way to these or to drawers, and too much that is uncleanly is apt to be tucked away. Transom windows and open doors should let in the light and air, and render it possible to send an overhead current through the building. High windows and ceilings, cleanly walls and painted floors, are needed far more here than on the lower story. The place for sleep, for sickness, and so often for the nursery, should have secured for it the best of ventilation. Sunlight and sun heat have so much to do with the regulation of temperature, dryness, etc., within the house, that it is greatly desirable that these be made available here. The entry, instead of being a dark recess for stairs and passageway, may easily be made to receive both sunlight and sun heat from skylight arrangements in the roof easily worked by pulley apparatus. Transom windows and open doors easily connect the various rooms with such a hall, and make of it an aid in equalization and modification of air and temperature.

Halls and Stairways. — The whole subject of halls, from basement to attic, needs re-studying. The plan has been tried in New York city with some success, of having entrance to the different stories by means of inclosed stairs outside, the inclosure also affording better locality for laundry, water-closets, and other appurtenances. It is at least feasible to change much the present plan of hall structure, and to deprive it of objectionable features. There is no reason why it should not be so connected with the attic and roof as to furnish aid to health and comfort, rather than be the vestibule of gloomy dampness.

The attic rooms are chiefly modified in their relations to the rest of the house by their proximity to the roof, and by the temptation to make them small and so illy ventilated, or to occupy them as places for storage. If they are at all to be secured from too sudden variations of temperature, they must have an inclosure of their own above entirely separated from the roof, and giving free access to currents of air. Their very situation requires additional provision, lest by smallness and closeness, and undue proximity to upper inclosure, they are rendered liable to excesses of temperature less conservative and self-regulating than those outside. The adjustments of heights of ceilings, of windows, of number and shape and size of rooms, is to be studied in this view.

Roof. — The roof of a house is too often lost sight of, although a very important part of the inclosure. If there are reasons why brick and mortar, for instance, form a good side inclosure in their relation to porosity, to circulation of air, and to temperature, the same demands are applicable to roof structure. If inlaid brick, or lath and plaster walls aid in dryness, or as a kind of atomizing medium for the introduction of pure outside air, the same is, or ought to be, true of the roof-structure. Shingles, or slate, or tin may prevent the direct inflow of water; but other relations to air, moisture, heat, and evaporation, are to be weighed. Other things being equal, the nearer we can imitate the side-structure so much the better. Greater exposure to direct sun rays, greater facility for evaporation, and the greater purity of the surrounding atmosphere at such an elevation, may even make us more anxious to study physics in direct relation to this fact. By the

mode of inclosure directly under the outside roof covering we do much to regulate heat and moisture. Many houses are made more uncomfortable in summer because the roof serves as a kind of outspread sun-glass for the concentration of heat, inevitably diffused to other parts. Generally bricks, cement, or other filling in, should be quite adjacent to the rafters, with air space intermediate, cr these so porous as to regulate air and moisture. Thus, care should be taken to avoid as much as possible the tendency to overheating in summer and excess of cold in winter, as well as to secure the required amount of ventilation. A material inside of the roof which would correspond to woollen as a clothing would have effect in regulating the heat within. Perforations from under the gutters for air entrance often aid much in equalizing the temperature. Future sanitary improvements in building will illustrate that by means of glass sash, and other roof openings, much can be done for the regulation of the hygienic condition of the building; and the roof itself upon its outside may come to be available for methods of relief, and conservancy to interior apartments.

Chimneys, etc. — Chimneys and their accessories are largely available throughout the various parts of a house for purposes of air circulation as well as for heating. Indeed, in the modern house, their arrangement should have large relation to the former. It is a close study of physics how so best to construct and arrange them as to make of them flues for both purposes. We may avail ourselves of heat as a mode of motion, so as to secure motive power for air, while at the same time securing right adjustment of temperature. The old-fashioned fireplace or glowing grate has been steadily advancing in favor of late, and the fireplace has an evident destiny to fulfill. Indeed, in all the house structure itself, so far as heat and ventilation are concerned, we are to seek to know how far these can be secured by the material used in construction, and its most perfect arrangement.

The rightly constructed house from foundation stone to chimney-top is itself both a heating and ventilating apparatus, to be studied as such, and to be relied upon and improved as much as many more artificial appliances. Contrasts in moisture, in temperature, in closeness, in all that marks change from the air just outside, are often largely owing to errors in structure more than to noxious admixture within. If a house is builded on wrong ground, with wrong surroundings, with imperfect drainage and cistern-like basement, with material badly adapted or badly combined, all the factors of dampness, mouldiness, disturbed temperature, yea, unhealthfulness in all its fullness is constructed. No wonder that we are puzzled over artificial ventilation, artificial heating, artificial drying, and all equalization. We have organized a failure. We have not recognized how conservative of health in these, and many other regards, a rightly constructed house can be. Often the abnormal sensibility of the inmates to cold or to changes of temperature, is due to invalidity introduced by undue wall-moisture or obstruction of air resultant from defective building. Hence an extra amount of heat is needed to adapt the house to the inmates, and to re-adapt the inmate to the house. Both of the organic structures are out of order, and artificial appliances are

compensatory rather than necessarily incident. This is one reason why we bear changes of temperature in the great open which we do not bear even when moving about in a confined house. There is caloric available by method of structure, and in the human system, and not the builder only but the hygienist must study the law of these adjustments. To fit the house material and arrangement to the occupant is often as practical as to fit the occupant to the house. In material and method of construction, we would have as the prominent and prevalent idea, so to construct and arrange as to secure the highest possible perfection of natural sanitation and compensate for the few complications involved. This is the problem anterior to all other household hygienic arts.

In such attention to the upbuilding of our American homes, we shall find that by adding to their health we shall add to the happiness and resources of their inmates. In so doing, we purify the very fountain-heads of national life, and do our part in imparting that vigor which tells on public prosperity no less than upon personal comfort.

SANITARY PRINCIPLES IN HOME ARCHITECTURE.

BY HENRY W. DEAN, M. D., OF ROCHESTER, N. Y.

SUBMITTED AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 9, 1875.

THE site for a well-appointed dwelling-house should be an isolated one, on porous soil, and at an altitude adequate to provide for self surface-drainage, selected with reference to its immediate surroundings, as soil, artificial drainage, sunlight, and pure air; and in its construction, special provision will be made for warming and ventilation, and for the admission of sunlight into every inhabited room. A source of great danger in the construction of homes, is the introduction of multitudinous appliances for *convenience* and *ornament*, at the sacrifice of sanitary features. A well-informed English sanitarian, in alluding to his own nation, has well said: "We . . . . have gone backwards and forwards as the ancients did, and in a generation we have many waves of opinion, because we do not learn sound principles, or, if we do learn, we do not teach them, that they may be continued." History proves this criticism to be just, not only of England, but of all the nations of the earth, in reference to sanitary subjects. Immediate and individual benefits have been studied, with but little regard to the ultimate and general good. Both communities and individuals, in the construction of dwellings, have lost sight of the great future; especially is this evidenced in matters relating to health. The agriculturist and the artisan build a house on the basis of business convenience. The affluent have builded, and continue to build, their houses and decorate their grounds more in order to exhibit their wealth, than to provide a sanitarium for their families. Towns are projected on every other plan than the health of their inhabitants. The money value of life and health to the Commonwealth is not appreciated.

The construction of tenements and work-shops so as to exclude sunlight and fresh air, is a prevailing evil in our villages as well as our large towns. The providing of work-shops in basements without sunlight, and badly ventilated, is a crime against sanitary law.[1] The insidious cause of ill-health in the populous parts of old towns, is, in very large measure, insufficient drainage, and to remedy the evil is well-nigh impossible. The destruction of individual property in the form of buildings, and the injury to landed property necessary in the construction of required drainage, would be im-

[1] In the basement-room of a manufacturing building in this city, are provisions for twenty to twenty-four workmen. The room, I think, has sixteen windows, 16 by 24 inches; in the room are two forges and a number of anvils. During most of the cold season the men are provided with loose planks or boards to keep them out of the mud. The steam, dampness, smoke, and dust of this room, are of course nocuous to the workmen, and the Health Board should have power to correct the evil.

mensely expensive, and to most people as impracticable as the proper cremation of the dead. In sparsely-populated rural districts, where beautiful and eligible building sites are abundant, it would not seem to be necessary to caution against selecting a spot for a home not having the potential sanitary provisions hinted at. But observation evidences culpable mistakes in this matter, and by men who exhibit good sense on most other subjects.[1]

An important consideration in the location of a rural home, in the absence of a public sewer, is the possibility of competent drainage. I shall say more hereafter of the relative value of public sewers and cesspools, but for the present I shall assume the fitness and desirableness of cesspools as receptacles for the sewage of a farm-house or rural home; a properly constructed and judiciously located cesspool is not only the sole resource for the isolated home, but may be made absolutely innocuous. Its particular construction needs no special description, but its connection with the house should be through water and air-tight pipes; and near to the house — just outside the stench-trap — should be provided an outlet-pipe extending to the top of the house, through which all regurgitant gases may readily escape. This is all prospective to the construction of the foundations of the house. In preparing the substructure, no provision should be made for anything more than a cellar. After providing facilities for the proper drainage of the cellar, the next consideration of prospective importance is to prevent the accumulation of dampness; and as indicative of my appreciation of the necessity for this care, I will state as my conviction that there are few, if any, localities where a cellar can be prepared, with the bottom so compact and dry as not to gather dampness sufficient to unfavorably affect the dwelling. To prevent this the bottom and side walls — nearly to the height of the outside earth — should be covered with cement, or other substance impervious to water. The average farmer would scout the neces-

1 A few months since I visited a family living in one of the most delightful regions in Ontario County. The house was on high ground, on sandy loam soil, with all the surroundings apparently as perfect, in a hygienic sense, as could be desired. On my way from the station, the driver informed me that a "hired man" had recently died from what was called typhoid fever, that the head of the family, a man about sixty, was now, and had been sick seven or eight weeks, and that a son and daughter in the same house had been sick two or three weeks. The prominent features of the sick people very forcibly reminded me of what I had been painfully familiar with for many weeks, in the case of a friend at home, who had suffered fearfully from the effects of sewer poison. I confess my examination of the patients was almost entirely for the formality of it. My first business was to examine the premises. The bottom of the cellar was damp, so much so that boards were used for the purpose of traversing it. In one corner of the cellar was the well, the water from which had supplied the family until quite recently. The well had recently been discarded from some suspected wrong about it. The water since used by the family was drawn from a well near to the barn, only eight or ten feet from which was a basement sheep-shed, the bottom of which was about eight feet below the ground surface and the top of the well; in this shed sheep and young cattle had been housed during the winter. The cause of the illness of the family I had no hesitation in defining.

In some respects the foregoing may be considered an extreme case, but it is by no means an infrequent illustration of the injudiciousness of arranging the united plans and relations of house, barn, and yards for purposes of convenience.

sity of all this carefulness, but he has not studied the cause of the oppressiveness of the atmosphere in his cellar after having remained closed for a few weeks; and while it furnishes barely enough of oxygen to supply a flame to his candle as he draws his mug of cider, he has no idea that he is harboring an insidious but certain poison to himself and family. In the estimation of most families this cause of domestic insalubrity is scarcely thought of, but the intelligent physician regards the confined atmosphere of the cellar as a source of house-poisoning. There can be no excuse in a dwelling, isolated upon open grounds, for insufficient sunlight, especially for the sleeping rooms, and other most occupied apartments. For perfectness in this respect the house must be planned with special reference to it, so that into every room direct rays of sunlight may be admitted; and then the good housewife needs to be instructed in the necessity of exposing her spare bedroom or chamber, and the parlor, to the sanitary influence of sunlight, and of discarding all carpets and other furniture which she is unwilling to subject to such exposure.

In the choice of material for house construction but little can be said from any carefully observed facts. The objection to stone and brick does not obtain in isolated dwellings with the same force as in the compact city. In town or country, it is fair to assume, on a sanitary basis, that wooden dwellings are more healthy than either stone or brick, although the modern-built brick or stone house is rarely plastered upon the wall, as was commonly practised until a comparatively recent time. In a well-constructed frame or wooden house, a single layer of brick or heavy-matched plank between the outer covering and inner wall-plastering will furnish abundant protection against cold, with scarcely any liability to the dampness of brick and stone walls. The manner of heating will be considered hereafter.

I wish to say a word against a prevailing evil in rural life, — that of planting and preserving too many shade trees in close proximity to the dwellings. If there were no danger from this source, the temptation to indulge in abundance of shade trees would be irresistible. If excessive, the foliage of the trees, or the vegetation shaded by them, originate a malarial element predisposing to pneumonic and diphtheretic diseases, and an illy-defined form of fever that scarcely admits of classification in the nomenclature of diseases.

Most of the towns in which settlement commenced a half century ago, were unprovided with any sewerage system, and as a consequence it is now well-nigh impossible to provide proper drainage for the old tenements; and when, as is often the case, such old tenements are crowded in great numbers into a limited and low district of the town, with scarcely a possibility of egress, how can the poison with which the earth is saturated be destroyed? By nothing less than fire, and it is doubtful if much of the filth in many of our large towns can be effectually purged by anything less than the great prophetic conflagration. In my judgment it is very much to be regretted that most of the sewers in our towns are placed in the streets, instead of the alleys, necessitating in many, if not in the majority of dwellings, the connecting of the culinary department of the house with the sewer through pipes under the house. Were it otherwise, namely, were the sewer pipes

placed in the alleys, the house sewage could be passed from the rear of the house where it is collected, back to the alley, thus saving the possible, indeed *probable*, impregnation of the basement rooms with sewer gas, which is pretty certain to escape sooner or later from the sewer-pipes as ordinarily constructed. As sewer-pipes must be used, and in most instances placed under the cellar bottom, the construction and the material of which the pipes are constructed, are of vital consequence. Most of the pipe heretofore used for this purpose, is composed of the ordinary tile cement. As conduits for large bodies of water, or matters with which water is largely intermixed, this material is abundantly competent. My experiments with uric acid and liquids containing a considerable proportion of urates, convince me that vitrified pipe is but slightly affected by long contact with them ; hence for uses in and about dwellings, where urine forms one of the constant contents of the sewer pipes, the vitrified pipe would constitute a safe conductor for the collection of house closets to the street mains. In connecting the house drainage with the street mains, care should be observed to make the connection as nearly to the bottom of the main as may be compatible with egress, from the well known fact that the gases occupy the upper portion of the canal, and will not so readily enter a lateral with a base as one with a top opening.

I have not at present any special interest in the construction of dwellings for the affluent. Given the sanitary principles in the substructure, the superstructure in its general appointments is commonly well provided for sunlight, and in the form and capacity of its living rooms. In the tenements and houses provided for the middle and laboring classes, the classes constituting three fourths or more of our population, and the source of a still larger proportion of native-born children, the State should see to it that such homes are made healthy, and preserved in such condition as to conduce to the maintenance of health. It can hardly be expected, at present at least, that men having the means at command will sacrifice so much of material interest as to build block tenements on purely health principles. I cannot conceive it possible that buildings providing for more than two ground or surface tenements can be made healthy. In large tenement blocks, only the front and rear are accessible to direct sunlight or fresh air. The division walls must remain damp forever. In this latitude what dampness evaporates during the short season while the doors and windows may remain open, is regathered during the longer cold and damp season ; hence the impossibility of perfectly drying the division walls. Artificial heat as a resource for drying brick or stone and mortar has not been found competent. This evil would be remedied in a great degree by providing for a free space of one or two feet between each double tenement ; this open space should extend from front to rear, and bottom to top of the building. The externals of the building thus provided for, by statutory law if necessary, its internal appointments should be made sanitary, in reference to capacity of sleeping-rooms, sunlight and ventilation. In an economic as well as sanitary point of view, the same measure of fresh air is as necessary to *preserve* as to *restore* health, hence sleeping apartments should be provided with the same

number of cubic feet of fresh air as is apportioned to a hospital bed. The importance of pure air in sleeping-rooms cannot be too strongly stated. Attacks of illness are prone to occur in the night season, especially with children. During any protracted disease, exacerbations are especially apt to occur between midnight and daylight; and medical men are too familiar with the stifling atmosphere of the sick room at these hours. With sleeping rooms on the first or ground floor, conditions of the out-door atmosphere might make closed doors and windows desirable in the night, as possibly the outer air might be more noxious than the tainted atmosphere of the house; but always and everywhere sleeping rooms should be as far above ground as possible. In town or country I believe there can be no exception to this rule.

Equally important is sunlight. The influence of a protracted sunbath in increasing the red corpuscles of the blood, and in improving the capillary circulation, are familiar facts to medical men. Health can neither be maintained nor restored without it. I cannot here resist the temptation to speak of the injustice and cruelty practised upon criminals by confining them in dark, damp cells. To take the life of a criminal in a legitimate way is right! But no man, nor any number of men, have a moral right to incarcerate a human being in any place beyond the reach of sunlight and fresh air. I need not appeal to the medical profession for evidence of the noxiousness of apartments from which sunlight and fresh air are excluded.[1] The case cited in the note below may be an extreme case, clearly illustrating

[1] An intelligent lady has recently stated to me that many times during the last two or three years, she has suffered very severe irritation in the fauces and larynx, from occupying as a sleeping-room an apartment to which direct sunlight had not access.

The difficulty is almost unaffected by any treatment so long as she continues to occupy that room, but disappears spontaneously when she occupies more favorable apartments; being to some extent a beneficiary in the family, she felt obligated to anticipate the convenience of the family in respect to a sleeping room.

A most notable exhibit of the poisoned condition of the atmosphere of a house from which these sanitary influences were excluded appeared in the family of a patron and former neighbor of mine. The man with his young and healthy wife, commenced housekeeping in a *then* old, low, wooden house, shaded in front by large trees, and on either side by comparatively high buildings. After a few months the husband began to suffer from attacks of diarrhœa and dysentery, and the wife from rheumatism, a complaint from which she had never suffered before. In due course of time a son was born, which, after repeated illnesses, at fourteen or fifteen months died of diphtheria. Not then appreciating the full force of the noxiousness of the house, I advised that they occupy the upper rooms for sleeping, although the rooms had low ceilings, and in summer were very warm. The two continued to suffer from their respective difficulties, but less severely. In the course of a few years two other children were added to the family. By assiduous nursing, and with the mother and children spending much of the warm season in the country, the children reached the age of puberty, the one an asthmatic and the other a rheumatic sufferer; the parents meanwhile becoming prematurely decrepit. After years of counsel, this family were induced to leave their old dwelling-house and occupy a more healthful home; and now, after a period of six or seven years, the parents and children are enjoying excellent health, and the doctor is minus a large annual professional fee. A few words further concerning the future history of that old house. The bottom of the cellar was cemented, and in the owner's judgment, the condition of the place was greatly improved. The next tenants of the house consisted of a man, his wife, and two children; after about four months one of the children died of diphtheria, and in a little less than sixteen months, the husband and father died very sud-

sources of disease that careful observation might develop in any city or town, but it is well for landlords that medical men are not made referees as to the healthfulness of rented tenements.

Concerning the heating and ventilation of dwellings much has been well written; but prevailing imperfections in both of these most important conditions to health, require repeated and careful consideration. Practically they are coincident conditions, — neither can be perfect without complete adaptation of the one to the other. Obviously, no one system or plan can be made to meet all cases. Perfectness is nearly synonymous with simplicity in this matter. The large predominance of people in the lower walks of life, in whose behalf I now speak, and who are unfamiliar with sanitary laws, claims special attention from the conservators of health and the interests of the Commonwealth. Medical men well know that the infectious causes of disease *remain* in the houses of this class of people, and when developed, extend to other and more salubrious districts; then the evil is recognized and fully appreciated! The great majority of our epidemics originate in these localities; the various causes of disease nursed in damp cellars and apartments which remain unventilated during the winter, cannot be destroyed by the better ventilation and warmth of summer. In small dwellings a double flue, one for smoke and the other for ventilation; better still, when more than one fire is used, a *triple* flue, the central one for ventilation, would meet the necessities quite completely. Whatever plan is adopted, it must be simple and constantly operative. Persons who are projecting new houses for their own families, generally have some preconceived ideas on the subject of heating and ventilation. I will venture briefly to describe the plan I would adopt for myself. After examining the questions involved I should give preference to indirect radiation from either steam-pipes or from wrought iron hot-air furnaces, for regulating the general temperature of the dwelling; and for the rooms chiefly occupied, I would provide properly appointed open fires.

House-drainage and its necessary plumbing works are next to ventilation in the sanitary outfit of dwellings. The luxury of water-supply and all its accessory conveniences of closets and waste-drains are found only in the modern dwellings of the more affluent classes. To question the propriety of this class of modern conveniences, would bring the critic into sharp conflict with architects, housekeepers, and people generally. Notwithstanding the popular verdict in favor of the mere conveniences connected with house-plumbing, I am satisfied that certain unhygienic consequences therefrom have caused family physicians more trouble, and our civic communities more suffering, during the last few years, than any other disease-producing agency connected with the modern home. In both private and public houses the evils are great and increasing.

denly of what was called *quinsy*. This sad event broke up the family, and the house was soon vacated. The property passed into other hands; the house was considerably renovated with fresh plaster, paint, and paper, and a new drain was opened from the house to the street sewer. The house was again occupied by a small family, to which, after six or seven months, an infant was added; in seven or eight days after whose birth the mother died of puerperal fever.

The safety of water-seals or "traps" will decide the safety of pipes in the living apartments of a dwelling. Having no theory to advance, I shall best define my personal convictions from experiments in my own family dwelling. I shall assume that the plumbing is as good as in the average of dwellings; all the work was done under my own observation; the relative diameter of traps, ingress and egress pipes, ventilation of soil-pipe, are all provided for according to acknowledged authority. The living part of my house was unoccupied during the last two summers, thus leaving the water-works for fair and careful experimentation. The basins, traps, and outfall pipes were flushed morning and evening, and then the traps filled with as gentle a stream of water as practicable, to prevent the effect of great momentum; the rooms in which experiments were made were kept closed, to prevent changes in atmosphere. In every instance, after ten to fourteen hours, the atmosphere of the room was found to be most unpleasantly saturated with sewer-gas. I am so thoroughly convinced that water is an insufficient trap-seal or obstacle to regurgitant sewer-gas, that I am prepared to declare such fixtures in the *living parts* of any dwelling *unsafe*. Science and art may obviate the objections, but of any system yet known to me, my own judgment is emphatically adverse to the introduction of outfall or drainage pipes connected with sewers, closets, and urinals, into the inhabited parts of a dwelling. An apartment for this special purpose, separate from, but connected with, the dwelling by an open corridor, providing all conveniences for the several floors or flats of the house, with but comparatively slight inconvenience, would secure the riches of health to the inmates.

A DISCOURSE ON THE PRINCIPLES AND PRACTICE IN DRAINAGE AND SEWERAGE, IN CONNECTION WITH WATER-SUPPLIES.

BY EGBERT L. VIELÉ, *Civil Engineer*,

BEFORE THE ASSOCIATION AT ITS ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 11, 1874.

THE first Sanitary Congress in America was held in Philadelphia, May 13, 1857. Previous to that event the barbarous quarantine codes which time had made venerable, were rigidly enforced; the sick were treated worse than criminals, and the restrictions imposed by ignorance and fear to prevent the spread of disease were not only cruel in themselves, but provoked the very results which were so much dreaded. In the language of Dr. Jewell, "They advocated antiquated and obsolete doctrines; they embarrassed commerce; oppressed the merchant; imposed severe restrictions on the healthy; and cruelties on the sick; which when rigidly enforced became the ready means of disseminating and entailing disease and death.

The great leader of that Congress, a true apostle of sanitary reform, was the illustrious Dr. Wilson Jewell, of Philadelphia. His words bore the stamp both of faith and of prophecy when he said, "The work of sanitary reform in our country has commenced in earnest, and my desire and prayer is to be engaged in this work in season and out of season, until I behold the first fruits of our united and persevering exertions displaying their rich influence in the organization of a well-ordered sanitary police embracing both external and internal hygiene through legislative enactments in all our large cities." None the less earnest as a champion of sanitary reform was the eminent Dr. John Bell, also of Philadelphia. To him the world is indebted for the most learned and exhaustive treatise — on the importance and economy of sanitary measures to cities, — that ever has or probably ever will be written. Replete with the wisdom and experience of the past, it will be for all time a guide in the future to the practical sanitarian, and so long as mankind is led by humanity, and directed by wisdom to provide measures of protection from pestilence and relief from disease, so long will the names of Jewell and Bell be honored and revered among men.

The crusade against ignorance in behalf of humanity, so well begun under the auspices of such eminent leaders, has been maintained until the present time, with what results let the diminished death-rate of our large cities and their marked immunity from pestilence bear witness. Those who have been more or less identified with this cause have come together for counsel and guidance, to exhibit what has been accomplished in the past and to plan what may be accomplished in the future by intelligent coöperation. So far as sanitary engineering is concerned, or that particular department of sanitary science which by virtue of my profession has come under my personal cognizance, I find great reason for congratulation in the progress which has

been made both in this country and in Europe. It is true that innumerable obstacles present themselves on every hand. The resistance which is always offered, even by otherwise intelligent minds, to what are regarded as new ideas, would be astonishing if it were not so universal. The capacity of the human mind to reject knowledge is very great, and in nothing does it show itself so obstinately as in those matters where science has to contend with social habits. Every step in this direction is opposed by a great force which might be denominated the " inertia of ignorance," and to overcome it is like removing a mountain. It has sometimes appeared to me that it required more skill, energy, perseverance and true courage to conduct a sanitary campaign than it does to marshal an army in the field. Ignorance and vice, avarice and greed, politicians and quacks, sordid contractors and corrupt rings, array themselves against progress until experience comes with its terrible lessons, to destroy the opposition that no other argument could remove. Hence it is that a convention like the one now in session becomes a great public necessity, for by it important facts are acquired, and through it they are disseminated with the force and power of the united action, so essential to success, especially in a cause like this whose magnitude extends to the very limits of human civilization.

Of all the problems embraced within the scope of sanitary science, none are more important, or should claim a larger share of attention than those connected with drainage and sewerage; since, of all the innumerable causes which, singly or combined, engender preventable disease, the most widespread and most certain is *the presence of an undue amount of moisture in the soil.* When we consider how universal is the presence of water in all created matter, forming the larger portion of the great globe itself, and more than three fourths of all animal and vegetable substance; constituting 795 parts in 1,000 of the blood, 789 parts of the brain, and 750 parts of the muscles; when we consider, also, its amazing power as a solvent, dissolving matter and absorbing its constituent gases with an incomprehensible avidity; when we think of its equally wonderful erosive power, wearing away mountains into plains, and washing the plains into the sea; and recognize it as the prevailing and most potent of all the powers of nature, we cannot wonder at the important part it fills for good and evil in the history of the world. To the action of water is due, to a large extent, the topographical configuration of the earth. The great upheaving forces that elevated the mountain-chains were limited in their effects and duration when compared with the abrading forces of the iceberg and the erosion of the waters. The latter is unceasing in its activity, destroying and re-creating, and were the earth's internal fires to sleep unmoved forever, so long as the dew falls and the clouds form, so long, for all time, will the surface of the globe undergo continued change from the action of water. Does it not, then, behove all men to know well this element of life and death; to study it not only with the microscope as it exists in the dew-drop, and learn its constituents, but to study it and know it in its all-pervading character in the rivulet, the river, and the sea; in its hidden channels, through the fissures of the primitive rocks; but, above all, in the supersaturated soils which surround him on every side.

Let us follow it for a moment as it rises in vapor on a summer's day. See it floating upward in fleecy clouds, until, in a higher stratum of air, it condenses and gathers into black masses, that roll and mingle, while amid quick flashes of electric discharge, and reverberating thunder, it descends in copious volumes. The parched soil eagerly drinks it, drooping vegetation revives, and the glad earth smiles in beauty from its refreshing influences. Were this to occur only at such times and in such quantities as are simply necessary, man would live in a perpetual paradise; but, unfortunately, far more water descends upon the earth than is absorbed, or required for vegetation. By reason of the physical conformation of the surface, a large portion of it passes by the rivers to the ocean; but a very large portion is permanently retained in the soil in excess of its requirements. And *this portion is the principal source of human misery throughout the world.* Man meets it as his great enemy on the threshold of existence. He meets it wherever he goes, in every part of the inhabited and uninhabited earth; in the crowded city, and in the secluded hamlet. It follows him like an unseen spectre. Its noisome vapors envelope him like a mantle; they chill the warm blood in his veins; they penetrate into his lungs and disturb all his organs of vitality; and when once they gain a foothold in his system, and a burning fever fills his veins with hot blood and his brain with delirium, the crisis of his life has come. Even if he recovers, a power has gone from him never to return. He rises from his bed like Samson shorn; the old vitality never, never comes back. I appeal to the medical profession to confirm the truth of this statement. Is there a physician of extended practice in either hemisphere who has not within the last twelve months had under his charge fifty or a hundred cases of sickness due directly or indirectly to malarial influences? Yet, what a strange indifference the great public exhibits upon this subject. Probably not one in a hundred thousand, either in Europe or America, has deemed it necessary to examine the surroundings of his own domicile, to see if a source of disease does not exist at his own door. On the contrary, we have only to look about us to see on every hand individuals constructing edifices, and communities constructing towns and cities with a reckless disregard of all the warnings of the past, and an equally reckless indifference to future consequences, in utter violation of those laws and principles upon which depends life itself. Take, for illustration, the following description of a portion of the city of Salem, from the Report of the Massachusetts State Board of Health for 1873. Speaking of the location of a very large number of cases of typhoid fever, the report states: —

"At the foot of Pingree Street is a sluggish body of water fouled by refuse of all descriptions, which taints the air of the neighborhood with its offensive exhalations. Near this water, on low land, are tenements whose occupants use little precaution to protect themselves from the stench of slops and garbage thrown on the surface of the ground, or from shallow and neglected privies. At high tide the waters find their way along the drain into the cellars of the houses. It surely is not strange that in this neighborhood during the past year occurred nineteen cases of typhoid fever. There is a sluggish basin of water lying to the north of Howard Street Cemetery and the jail (fit proximity). This basin is of triangular form, bounded by Bridge Street, the Eastern Railroad, and the land lying back of Northey

Street. It covers three or more acres of flats. *Into* it flows the drainage from St. Peters Street, Howard Street, Oliver Street, Northey Street, and portions of Bridge Street; also the drainage from the Gas Works. Formerly the coal-tar from these works was allowed to flow to waste, but since it has become valuable for coloring purposes, it is retained, and only the ammoniacal liquor is allowed to flow away. So that, whereas formerly some little antiseptic action was derived from this drainage, now it aggravates the baneful condition of the waters by promoting decomposition. Each spring, with the annual clearing of gardens, flower-stalks, brush, and all sorts of refuse are emptied along the banks of this basin. On the Northey side there is a low shore overgrown with sedge-like grass. The only outlet for these waters is by a culvert under the railroad. The emptying of the waters with the ebbing tide is so slow, that decomposing animal and vegetable refuse settles among the brush and grasses on the shore and on the flats. Near the Gas Works, leading from Northey Street to the basin, is Woodbury Court (a short court with five or six houses on each side). In the two houses immediately bordering the water there have been five cases of typhoid fever this season. Half way up the court have occurred two more, and not far from the head of the court three others, making ten cases in the neighborhood this autumn. In the immediate vicinity there have been twenty-one cases of typhoid fever in all. *All this is due to defective drainage.* And before vigorous measures can be adopted to improve the sanitary condition of the city, the authorities must appreciate the dangers which are imminent. This *neither they nor the people seem to do.* The nuisance remains the same, although public attention has been repeatedly called to it."

All this refers to a locality in one of the oldest, most refined, and healthy cities in the intelligent and progressive State of Massachusetts, of which Boston, the intellectual centre of the United States is the capital, and yet not even the barbarism of Central Africa could excel this scene of human degradation and filth. Of the city of Lowell, in the same State, the report says: —

"The system of sewerage in Lowell *has always been imperfect.* In many places there are no sewers at all; in others the pipes are of insufficient capacity, or not low enough in position. There has always been great confusion as to their location, owing to the imperfection or absence of maps. Two years ago there occurred here, especially on Marion and Cross streets, an epidemic of typhoid fever. At that time, and *since then, the sewage filled many of the cellars.* On investigation a mass of filth was found which filled the entire calibre of the drain-pipe for some distance. This pipe was also found to be too small and not low enough to create a current."

These are not cited as exceptional cases; on the contrary, there is reason to suppose that the same state of things can be found to exist in almost every city and town in the country. The responsibility is not always due to ignorance, for, unfortunately, while there are many people in this world who know too little, there are also some who know too much. There are quacks in every profession, quack doctors, quack lawyers, quack soldiers, and quack engineers, men who, having been gifted with an excess of conceit and cunning, use these qualities in the absence of more substantial ones, and succeed, by a pretension to knowledge, in imposing upon credulous people. In all local boards there is generally to be found such a character, who thinks he knows more than any one else. The city of London was for a long time victimized in this way. That city, as we all know, has suffered terribly in the past for want of a proper system of drainage and sewerage. The plague carried off 100,000 people, and this was almost entirely due to defective drainage. For a period of ten years they were struggling to attain a correct and thorough system. A new commission being appointed

by parliament nearly every year, each time, just as they were arriving at a practical result, some person, generally a member of the commission, or a particular friend of a commissioner, would bring forward a plan differing from all the others; this would prevent the adoption of any plan, and so it went on for ten years, until the matter was placed in the hands of one man, Mr. Bazalgette, who has achieved wonders by simply adopting a comprehensive plan, based upon common sense principles.

A practical system of drainage is one, the key of which is the topography of the site to be drained, and any attempt to carry out a plan not based upon the topography must necessarily end in failure. When I speak of drainage, I do not include sewerage. Drainage and sewerage are entirely distinct, and can seldom be combined, and then only to a limited extent. Drainage is the removal of the surplus water from the soil; sewerage is the removal of water introduced by means of an artificial water-supply, to which is added excrementitious and other refuse matter which the force of the water conveys into the sewers. It follows that sewers should be close conduits to prevent the escape of gases, while drains should be so constructed as to admit of the percolation of water into them from the adjacent soil.

Let us suppose, for instance, a site to be selected for a future town or city. The topography of the surface indicates a valley between undulating, grassy hills, interspersed with meadows and fields, and dotted here and there with trees. Through the valley runs a limpid brook sedgy and rocky by turns. In its pure bright waters the sun is reflected as in a mirror. The beauty of the landscape, the uncontaminated air, the pleasant sounds and delightful odors shed on all around a grateful influence. A scene so fair as this should certainly not be despoiled in making it a habitation for man. Much less should all those attractive surroundings be converted into health destroying influences, and yet it is universally the case that the occupation of such a territory by a large number of people, seems to be the signal for the exercise of every desire that human ingenuity can conceive to destroy its pristine purity. The soil soon becomes saturated with putrescent filth; the stream becomes a receptacle for every kind of refuse, and its sluggish waters are black and filled with poisonous gases. The natural drainage being interrupted by the grading of the roads and streets, the surrounding soil is soaked with water, and the lives of the people pay the penalty. By what simple means can this be avoided? All that is necessary to do is to make the plan of the town conform, if only in a general way, to the topography of the surface. The streets and avenues, instead of being impediments to drainage, may serve to facilitate it. A system of drainage becomes easy to adopt, and the most universal cause of disease is in a large measure avoided. But even if such a course is not adopted with reference to the original plan, it is nevertheless *imperatively necessary* that the streams and water-courses should be preserved by underground drains, and also that lateral drains should be constructed to take up the water emanating from perennial springs. If this is not done in the beginning, when it can be done easily and economically, it will have to be done in the end, when the task is surrounded with difficulties and at an enormous cost, when the

safety of the lives of the people demand it, and after the pestilence and the graveyard have demonstrated its absolute necessity. The city of New York affords the most striking example of the errors committed in this respect, and the evils arising therefrom that can be found on either continent. Probably there is no spot in the world so well adapted for a great commercial *entrepôt* as the island on which New York is built, surrounded on all sides by wide and deep water-channels, having a well-defined water-shed, combined with every variety of surface, varying in height from five to one hundred and fifty feet above high-water mark, blessed by a climate of unsurpassed salubrity, it has, nevertheless, been ravaged by cholera and yellow fever, while the utmost vigilance is required to prevent the outbreak and spread of small-pox, diphtheria, and the whole class of low fevers. All this is due, in a very large degree, to the fact, that in laying out the plan upon which the city has been constructed, the existence of a vast system of drainage streams was entirely ignored. Miles and miles of running streams, fed by innumerable perennial springs, permeate the original topography in every direction. Over these the streets have been graded, the intervening blocks filled up, and acres of buildings erected, and beneath lies the undrained saturated soil giving off its damp chilling malarious air. It is true that herculean and eminently successful efforts are being made by an energetic and wise Board of Health to remedy all this; but think, for one moment, of the task before them, — the time, labor, skill, and money required to accomplish what might have been so easily done in the beginning! In one district eighteen miles of underground drains have been laid down within the last three years, at an expense which would have drained the entire city in the commencement. Startling as all this is, every city and town in the United States is following recklessly in the footsteps of New York, and in the end will pay the same penalties. Memphis, in mourning for her decimated population, repeats the sad story!

While this matter of drainage is the first great step for all *communities* to take, it is none the less a necessity to *individuals* — the residents of the detached villa and the farmhouse. Wherever and whenever an excavation is made in which to construct a cellar for a house, there necessarily occurs an interruption to the natural drainage of the soil. The underground channels for the percolation of water are intercepted, and must be restored by the construction of a drain below the level of the cellar, and all the surrounding area requires a system of drains connecting with the main outlet. To neglect this is perilous. How many houses constructed after elaborate and well-considered plans, executed under the influences of bright hopes and happy auspices for the future, have proved the gateway to death from the neglect of these simple principles!

Examine the admirably designed and graphic charts that illustrate the vital statistics of the last census. The varying shades of crimson tell us that malarial and typhus fevers prevail all over the United States in greater or less intensity, and while knowing that the chief source of this wide-spread calamity is saturated and undrained soil, how painful it is to reflect that the least expensive of all the efforts that man is required to make to secure

for himself a healthful and a happy home, is the simple draining of the soil? Even for agricultural purposes draining is the most remunerative of all labor, and experience has shown that draining for agricultural profit has been in many insalubrious districts, attended by an immediate diminution in the death-rate. In the dominion of Canada I saw last month the most extensive system of drainage probably ever executed, successfully carried out under the combined action of the government and of individuals. By virtue of an organic law certain main drains of great extent and capacity are opened by the government and paid for by a general assessment. Connecting with these are lateral drains opened by the owners of estates at their own expense. Thorough drainage of an extended area is thus secured by a general and uniform system. Those who are directly benefited by it pay the expense, while the public at large obtain immunity from disease. I recommend this wise and beneficent law for general adoption in this country. One word more in reference to domiciliary drainage. We observe throughout this country that on the premises adjoining every isolated or detached residence, there are generally three excavations made, — one for a cesspool, one for a privy, and another for a well. They are generally, also, in perilous proximity to each other. The well, of course, is always the deepest, and if the soil is porous, it necessarily receives the leakage from the other two, especially as all three excavations are always faced with stones laid without mortar or cement precisely in the manner that drains are constructed to admit the percolation of water through the interstices. It seems absurd and almost impossible, that the receptacle provided for securing a constant supply of pure water should be universally so constructed that every possible opportunity is afforded for destroying the purity of that water, and not only this, but that a plan should be generally adopted for positively insuring its contamination by so constructing the receptacle for refuse matter that the liquid can readily penetrate through it into the well. And yet *nine tenths* of the homes of our people throughout the land are so arranged. The use of hydraulic cement in these constructions would obviate all this. In addition to which the overflow of the cesspool should be made to pass through charcoal, and further, dry earth or charcoal deodorization should be constantly used in the privies.

There is one great source of evil through soil-saturation, which, although almost universal in extent, has not received that attention which its terrible importance demands. I allude to the construction of mill-dams. The great variety of surface which characterizes not only a large portion of the United States but that of nearly every State and county and town naturally results in innumerable valleys through which flow the waters which make up the river system of our country. The rushing torrents of these rivers and their countless branches are everywhere stopped in their courses and made to furnish the motive power for tens of thousands of mills and factories. To do this dams are constructed across the beds of the streams, behind which large bodies of water are accumulated to be gradually drawn off as it may be required to turn the wheels which drive the machinery. The water which is thus dammed back saturates a large amount of soil in

every instance, and this is probably the most fruitful source of malaria in the country. In addition to this the bottoms of the artificial ponds thus formed become a mass of decomposed vegetable matter, to which, by carelessness, much decomposing animal matter is almost invariably added. This deposit is necessarily exposed to the direct action of the rays of the sun each day when the water is drawn down in the working of the mills. The consequence is that in the vicinity of all these mills there are always a large number of cases of typho-malarial fever. In one instance under my own observation, there were at one time twelve hundred cases of fever due to this cause. And a physician stated to me that he knew in his own practice of one mill-dam that did not yield an income of four hundred dollars that had caused the death of twenty persons. This great evil extends over our entire country. What is the remedy for it? I would not for a moment propose to interfere with the industrial resources of our land. I would not have a factory stop or a single mill cease to yield its bountiful products; on the contrary, I would increase the number of these necessary adjuncts to an active civilization. I would conserve the latent force of every drop of water that a beneficent Providence sheds upon the earth, but I would do it in such a way that it should be always a blessing and never a curse! I would make every mill-dam through the length and breadth of the land what it ought to be, a properly constructed *reservoir* of pure water, free from all contamination, instead of being a stagnant pond of putrid filth! I would have their form and construction a matter of statute law as clearly defined as the law against homicide and arson! and the violation of that law followed by criminal punishment. A very little additional cost in original construction would confine these mill-ponds to a properly defined space from which all vegetable matter should be carefully removed, and the sides protected by walls from contact with vegetation. This would deprive the water entirely of its malarial influence. The sooner our legislators take intelligent action in this matter, the importance of which cannot be exaggerated, the better will it be for them and for our country. And let us hope that the time is not far distant, when an ignorance of sanitary laws shall debar the aspiring statesman from enjoying the honors of public position. As well might a man attempt to sail a ship who had never before seen the ocean, as for one to attempt to legislate intelligently for the public good, who is ignorant of the laws of health.

Sewerage. — I have already stated that sewerage is entirely distinct from drainage, it being the essential accompaniment of a water supply, since without an ample supply of water no system of sewerage could possibly be maintained; and yet, even with an abundance of water, I confess, with a great deal of mortification for the engineering profession, that the sewerage of nearly all the large towns and cities of the United States is a failure, since everything may be regarded as a failure that does not fully accomplish the object for which it was intended. Unfortunately, while the profession of an engineer involves a very large amount of responsibility, including in a great measure that of human life, it is surrounded by no legal enactments, like the professions of law and medicine, by which a certain degree of skill

is secured in its practice; and it too often occurs that an ignorant and incompetent person assumes the title of engineer or architect, and through personal or political influence becomes charged with duties for which he is entirely unfit. It was long ago said that "fools step in where angels fear to tread." The problems connected with sewerage are numerous and intricate; they have engaged the earnest thoughts of able minds for many years. The illustrious Liebig gave to its economic consideration the widest research and most profound philosophy. Man finds in it a spirit which he himself has raised, and which it is difficult to exorcise. The great cities of London and Paris have labored for centuries to control the vast proportions which it has attained through an enormous and increasing population. Its problems and difficulties multiply with every change of circumstance. A system thoroughly adapted to one locality might be utterly useless in another. But the principal cause of failure arises, in most instances, from a want of breadth in the original design. It is easy enough to convince people that their town or city will one day be a large centre of population; but when it comes to paying for the construction of a main sewer five or six feet in diameter, in anticipation of a large increase in population, while one which is two or three feet in diameter will answer the present purpose, the tax payers generally decide in favor of the small sewer, so that the engineer is not always responsible. As well might we expect the veins of a child to suffice in capacity for the blood circulation of an adult, as to hope that the system of sewerage which is only sufficient for a small village, will answer the purposes of a large city. Any plan of sewerage, to be effective, must not only be comprehensive in design, but must be based on an anticipated growth of population. The principal points to be considered are —

1st. The original configuration of the ground, and natural valleys of drainage.

2d. The artificial changes of the natural surface by the grading of streets and avenues.

3d. The rain-fall, or amount of water discharged from the clouds during the year upon the area to be sewered.

4th. The water supply, or amount of water distributed to the inhabitants daily from the reservoir and water works. It will be seen that the surface drainage of graded streets is included in the sewerage system, but this is distinct from the natural drainage through old water-courses, from springs, etc. The imperfections in a system of this kind arise from a want of proper judgment in determining the size, form, and location of the sewers, sometimes from errors either intentional or accidental in their construction, and sometimes from want of proper material used. But one of the chief causes of trouble is a want of proper descent to allow a free flow of the sewage. After all, however, the main difficulty is what to do with the enormous accumulations of sewage matter which must result from even the most perfect system. This is the all important problem which the great cities of the earth are trying to solve. London has endeavored to do it by means of low, level sewers; and although they have succeeded in purifying the Thames, and thus removing a great source of evil, they have not yet arrived

at a satisfactory utilization or disposition of sewage. The municipal council of Paris has (it is stated) adopted a plan for cleansing the Seine, by which the sewage deposited in the river will be directed to the plains of Gennevilliers, with what degree of success remains to be determined. Captain Liernur, a civil and military engineer of Holland, has perfected a pneumatic system for the removal of sewage matter, which is now under trial by the city of the Hague. Earth closets as a substitute for sewers are being extensively and successfully used in England, and in this country; of one thing there can be no question. The successful plan which can economically remove without offense the refuse matter of cities beyond their precincts and apply it to the restoration of exhausted soils, will be one of the greatest of blessings. The increasing importance of this subject is more apparent in this country than elsewhere, by reason of the rapid increase in population, and the establishment and growth of new towns, especially in the interior, where difficulties occur that are not experienced along the seaboard. The same stream of water is often the source of water supply and the receptacle of sewage ; the consequence resulting therefrom cannot be considered problematical. For instance, Newark, Hoboken, and Jersey City, in New Jersey, obtain their water supply from the Passaic ; while the city of Patterson, a large manufacturing centre, discharges its sewage into the same river at a point higher up the stream than that from which the water for those cities is taken. It is vain to hope that the sewage will be so diffused in running water that it will not contaminate it. Organic matter has always been the readiest means of propagating contagion, and in no way can it be so readily distributed as in water.

There are many minor points connected with this subject which the limited time at my disposal has not permitted me to discuss. The leading points which have been presented will, it is hoped, stimulate thought and inquiry. The condition of all our cities and towns requires to be carefully examined, especially with reference to improved methods of drainage and sewerage.

The fearful exhibit of the annual mortality from preventable causes throughout our otherwise favored land, calls for the active exertions of all intelligent men towards the removal of these causes. Wise counsel and wise legislation are needed. All classes of our people require instruction on this subject. Associations for this object should be formed in every city, town, and hamlet. Public lectures should be delivered, sanitary tracts distributed, and the leading principles of sanitary science taught in the schools. Our people, otherwise so intelligent, should not be suffered to remain in ignorance of truths so vital to their welfare. The ignorance of one individual may destroy the health of an entire neighborhood, as the match lighted by a thoughtless child may create an extensive conflagration.

The progress made in sanitary reform during the last decade is a happy augury of what may be accomplished in the future, although the field is large and the laborers few.

A REPORT ON THE DROWNED LANDS OF ORANGE COUNTY, NEW YORK, AND SUSSEX COUNTY, NEW JERSEY, AND THE SANITARY AND ECONOMIC IMPORTANCE OF DRAINAGE FOR THEM.

BY PROFESSOR GEORGE H. COOK,
State Geologist of New Jersey.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 10, 1875.

THE tract of country which is the subject of this report, is not larger, or, of itself, of more importance than many other tracts of marsh or swamp land. But it lies in the midst of a rich and attractive country now thickly settled ;

NOTE. — The Drowned Lands described by Professor Cook have been so much quoted as an example of neglected drainage that the plan and results of the drainage of them will eventually be largely quoted in the history of sanitary works. As early as 1742, Dr. Cadwallader Colden, the Surveyor General of the Province of New York, depicted the insalubrious condition of this undrained region, in the following terms : —

" . . . . The Paltz-river, or Wallkill, in Ulster county, in this province, has been long taken notice of as very prejudicial to the health of those who live near the banks of it. The waters of this river are of a dark color, and come from a large space of ground, overflowed with stagnating waters. The inhabitants along this river are yearly afflicted with intermittent fevers, during the summer season, and a constant fog or vapor is observed almost all the summer (except in the time while the northwest or northerly winds blow), to arise over that river, and to remain there at a certain height and distance every morning." [1]

In 1809, Dr. D. R. Arnell stated in a report to the State Medical Society of New York, " that an Act was passed before the Revolutionary War to enable the proprietors of those lands to drain them. An attempt was then made, and about two thousand pounds expended, at the outlet of the Wallkill ; but the Revolution coming on, put a stop to their labors." He also stated that " . . . . along the Wallkill and Otterkill, or Murderer's Creek, the tertian intermittent and remittent fevers prevail to a great degree in the fall of the year ; but on the west side of the Drowned Lands, they put on a more dangerous and formidable appearance than they do in other parts of the county." [2]

Thus has testimony to the public necessity of drainage been borne in five or six successive generations of inhabitants of the region of this malarial or drowned land. The problem is simple, for as Professor Cook has shown, it consists in cutting through a few obstructing lips of rock and hard earth, and straightening the channel of the sluggish Wallkill. Two counties and two States share the responsibility and must share portions of the cost of the drainage work. This is a typical instance of drainage for health, which the State should order and provide for, and the cost of which, when assessed upon the drained lands could be repaid many times. This vast swampy basin has been mentioned by medical and sanitary writers, for more than fifty years, as an illustration of a general cause of insalubrity as well as the waste of 25,000 acres of rich bottom lands. This Report is designed to show how the Sanitary Drainage of an obstructed river basin may be planned and executed. — E. H.

[1] Cadwallader Colden on the Fever of 1741 and 1742, p. 323, *Med. and Philosophical Register*.

[2] A Geographical and Topographical History of Orange County, New York. *Medical Repository*, vol. 6, 1809.

and there is pressing need that everything which tends to disfigure the land or injure the health of its inhabitants should be removed. The Drowned Lands, as they are called, are the flat lands along the Wallkill, which are subject to overflow in time of freshets; they are about forty-five miles northwest from the city of New York. The Wallkill rises in the southern part of the County of Sussex in New Jersey, and runs north-northeast through that county, and the counties of Orange and Ulster in New York, emptying into the Hudson at Rondout, a hundred miles above New York. Its whole length is more than eighty miles, and it drains about one thousand square miles of surface. But the part of the Wallkill valley which contains the Drowned Lands is entirely south of the New York and Erie Railway, and the area drained by this part of the stream approximates three hundred and eighty square miles. The lower end of the Drowned Lands is on the Wallkill, about three miles west of Goshen in Orange County, and the lands extend upwards along the stream to near Hamburg in Sussex County, New Jersey, a distance of twenty miles in a direct line, and of thirty-seven miles by the course of the stream. They also extend seven miles up the Póchuck Creek, one of the branches of the Wallkill. The extreme breadth of these lands is four miles, — and their area is 25,600 acres, of which 15,600 acres are in New York, and 10,000 acres in New Jersey. Through the entire course of the stream in these lands the fall is less than three inches to the mile, and the current is scarcely perceptible. After heavy falls of rain the stream becomes swollen and overflows its banks, and these lands are soon covered with water, remaining so for weeks together. In the present condition of the stream there is no chance for improvement; ditches are of little use for lack of an outlet, and nearly the whole of this area is ruined for the best agricultural uses. Some of the land is in swamp; other parts are attached to farms, and coarse and sour grass is gathered from them, when the seasons are not too wet. Along the borders of the upland, some of this ground is cropped, and fine returns are obtained, but the greater part of the area is utterly useless.

The character of the obstructions in the stream which have caused this cessation of the current, and the growth of the marsh, will be understood by a reference to the accompanying map and profile. The valley of the Wallkill from Goshen on the east across to Denton on the west side is filled with a heavy body of gravel and earth, which has acted as a dam to hold back the water in the stream above; this has existed for ages past. Originally the bottom of the valley above this dam was somewhat rolling ground, low hills with intervening hollows, but mostly lower than the bank of earth at Denton. This valley has gradually filled up with mud and black muck and now presents a uniformly level surface, except where some of the hills rise above the marshy ground and constitute what are called "Islands." The soft marshy ground which has filled up in this way, is in some places more than twenty feet deep, and depths of ten and fifteen feet are common. Where the stream runs over some of the higher parts of the original hard ground, its bottom is higher and appears as an obstruction to the flow of the water. The profile shows some of these obstructions near Black Walnut

Island, and also near the boundary between New York and New Jersey. These obstructions it will be perceived are natural and have always been sufficient to hold back the water, but they can be removed without a burdensome expense, and the interests of economy and of health demand their removal.

At the lower end of the Drowned Lands the stream passes across the earthy obstruction mentioned, and then has a fall of twenty-four and a half feet in two and a half miles. In the early settlement of the country this fall was turned to use in driving two mills. And one of these is said to have had its dam so high as to raise the water two feet in the Drowned Lands. As early as 1803, or 1804, this dam was lowered so as not to cause any rise of water in the stream above, but the presence of the mills and the value of the water-power remained as hindrances to any further improvement until 1830. At that time authority was obtained from the State of New York to drain these lands; commissioners were appointed, the mills were bought, and a ditch was dug parallel to the stream and about three-quarters of a mile east of it, from a bend in the stream at the lower end of the Drowned Lands, to a point in the Wallkill below the fall. This canal was sixteen feet wide, eight feet deep, and three miles long. The expenses, which amounted to $70,000, were raised by taxation of the lands benefited. The water flowed through the canal instead of by the old channel, and the effects of an increased current were soon apparent. The passage widened out from the original sixteen feet until, in one place, it was seven hundred feet wide, and in most of its length it is over one hundred feet wide. In depth, the bottom has cut out so much that the original channel to the mills is left entirely dry, and the bottom of the new channel is scooped out in holes twenty feet or more deep. After the work of cutting the canal, paying the expenses, etc., was done, the commission closed its work. But the owners of the land adjoining the new outlet were alarmed at the extent of the wear upon their land, and, to prevent its further extension, put a dam in the ditch to check the flow of water. There has been litigation, quarreling, and violence over this dam, and it is partly broken down now; but it probably still acts in some measure to check the force of the current. This canal has improved the condition of the Drowned Lands, but it was not enough, — and more drainage can be obtained at a reasonable expense, — as can easily be made to appear by a little study of the accompanying profile of the river bottom, and of the plans for its improvement. There is still fourteen and eight-tenths feet fall in the three miles of the canal; and from the upper end of the canal to Ogden's Bridge, below Hamburg, the rise in the stream is sixteen and two-tenths feet, or thirty-one feet fall in the whole. By cutting off a few bends in the channel, the stream between the two extreme points can be shortened to thirty-one miles or less. This, if we can bring the bottom to a uniform grade, would give a fall of one foot per mile. A fall in the stream of this amount would be sufficient to produce a lively current through the whole length of these Drowned Lands.[1] It is not likely

[1] The straightening of the stream could easily be carried out, so as to diminish its length ten miles, and by that means a fall of one foot per mile could be secured; or, taking the

that a work of this magnitude would be undertaken at once; and it may be that it will be found more effectual to straighten the channel for the stream, and in that way complete the improvement. What can be best done, however, is to make the work a progressive one; to first fully open and deepen the outlet canal or ditch, so as to provide sufficient water-way and fall for the floods to run off as fast as they accumulate; and afterwards going up the stream to lower or remove obstructions in the channel through the marshy lands as they come into sight. In this way no unnecessary expense need be incurred, and the whole cost would not be burdensome to the country or the parties owning the lands.

The economical advantages to be derived from this drainage are very great. They will be more fully appreciated if we consider the location of the Drowned Lands, their inherent agricultural value, and their nearness to the great centres of population in our country.

These Drowned Lands lie in the midst of the Great Valley of the Eastern United States. That remarkable and interesting valley which extends from Canada to Tennessee, and which, in its length, comprises the valleys of Lake Champlain, of the Hudson above West Point, the Kittatinny Valley of New Jersey, the Lehigh, Lebanon, and Cumberland Valleys of Pennsylvania and Maryland, the Shenandoah, the New River, and the Holston Valleys of Virginia, and the Valley of East Tennessee. This great Valley, so remarkable for the richness of its soil, the abundance of its agricultural products, and the wealth of its farmers, has nowhere else in its whole length so much of worthless and waste land.

These lands, as they become drained, are susceptible of the highest improvement. Some of the more elevated portions near their borders are so improved now, that heavy crops are raised upon them. Grass, for hay and pasturage, grows most luxuriantly upon these grounds when they are drained. Corn is also a large and sure crop. Fifty, sixty, seventy, and even one hundred bushels per acre of shelled corn are grown on them. Fine crops of potatoes are also grown upon this soil. It is not so well adapted to the growth of wheat, rye, and oats; onions grow remarkably well, and they are a staple crop, — one thousand bushels per acre have been raised on similar black land in Orange County. The surrounding farms are worth from $100 to $200 per acre; dairying is the leading business of the country. These lands, properly reclaimed, will yield more grass and pasturage than the adjoining uplands; they will cost less for manures and tillage, and will suffer less from drought. Of the truth of these statements, I am sure, from an extended observation of similar lands drained in our own country, and from visiting the reclaimed lands in the fen country of England, and the polders of Holland. A small part of the Drowned Lands is now worth $200 an acre, more of it is worth $100 an acre, still more $50, but a very large part is only valued at from three to five dollars an acre, and the average for the whole cannot be above fifteen dollars. This would make the value of the

stream nearly as it is, a uniform fall of eight inches per mile can be secured by simply removing prominent inequalities in the bottom of the channel. A grade line is drawn on the profile with this inclination.

whole tract in its present state $384,000. To any one who has ever seen the capabilities of bottom lands for yielding pasture and hay for herds of cattle, $100 an acre will seem a low valuation to put upon these lands when drained, and I have no doubt they will be worth much more than that. But at that valuation they would be worth $2,560,000, or an advance of more than $2,000,000 on their present price. Besides this increase in valuation, a great benefit would also be derived by the adjoining country in the removal of a discreditable waste from its vicinage. At present the marshy ground is so broad, and the mud so deep and soft, that it is expensive to build roads and bridges across it, hence there is very little communication between the people on opposite sides of this waste. There are only five roads across the Drowned Lands in the whole twenty miles of its length, and there is one reach of five miles, and another of six and a half, without a road. The thorough drainage of these lands would transform them from unsightly waste to a district of rural beauty, and would absolutely create millions of capital for the comfort and use of the people.

The sanitary importance of draining the Drowned Lands may be stated in few words. The whole of the great valley between the Hudson and the centre of Sussex County, N. J., is a great sanitarium for the people of New York city and the smaller cities around it. Thousands of families leave these cities for the hot months of July and August, and take board with the farmers and other residents of the valley. They find in this country air, in the rolling ground, the grassy surface, the good roads, and the pleasant surroundings, health, vigor, and recreation. So great is the number flocking to this convenient and beautiful country, that in some parts every house has its summer boarders, and more wish to come. Such a place of retreat for the unhealthy season is a blessing to the cities and a benefit to its own people, and its advantages are sought for by increasing numbers every year. The Drowned Lands are in this district, but no summer visitors take board along their borders; they look upon marshes, swamps, and stagnant water with distrust, and shun any near approach to them.[1]

The whole of the Drowned Lands were laid under water by a heavy and long continued rain in August this year, and an immense amount of damage was done to crops, especially hay and pasture, more damage, probably,

[1] Hon. Wm. Owen, from near Pine Island, says: "Chills and fever are common, in autumn, everywhere along the borders of the Drowned Lands and on the Islands. Before the outlet was cut there were seasons in which the majority of the residents were sick with intermittents. Since that time such diseases have been less common, though they still prevail to an unpleasant degree. The hill country which borders this part of the valley is entirely exempt from chills and fever. It is thought, too, by some careful observers, that pulmonary disease is more common along the eastern border of this tract than it is along its western side, owing to the prevailing westerly wind, which carries the damp, chilly air from these wet and really Drowned Lands."

I should be glad if I could present here some statistics in regard to the extent and locality of the sickness produced by the malarial influence of this tract of wet and marshy land, but I have not been able to learn that any such statistics have been collected. The facts, as I have stated above, are, however, beyond question, and only express the common opinion of the residents. A very intelligent gentleman, who has lived on the margin of these lands all his life, assures me that I have not overstated it.

than all the cost of thoroughly draining the ground; but water remained on so long that the summer heat was passed before the dead vegetable matter was fairly exposed, and there was no unusual prevalence of chills and fever this year. Wm. B. Braduer, a very intelligent physician, practicing not far from Drowned Lands, and mainly along one of the streams which empties into the Wallkill about the middle of this tract, has sent me the following: —

"Our creek flows through and should drain three thousand acres of heavy boggy land, but probably half of the year two thousand acres are overflowed and covered with stagnant water, and then slowly drying into pools and water-soaked soil, and in very dry seasons becoming passably free from water. Now, last spring the rains were sufficient to cover these lands, and it was summer before they were dried out; but the summer was very dry at first, until nearly all the marsh land was drained, and dried up, then came the heavy rains, and everything was again afloat there, then another dry time followed. The result is this, miasmatic diseases have reached a pitch unknown here for forty years, and who can doubt the cause? When I say forty years, I refer to a historic period, for about that time the physicians residing here compelled the citizens to destroy a mill-dam below the village, and thereby secured a passable drainage of the meadow lands lying south of us. They did so in hopes of removing the cause of a most terrible fever then prevailing here, and when the mill-dam was gone and the meadow drained, that was the end of the fever. The same creek is now choked with debris and sand bars, so that we are now suffering in the same way our fathers did nearly a half century ago. I have attended very many cases this year, nearly all of them occurring in the valley. True, some were sick in the mountains, but it is a noteworthy fact that every case I have seen sick with any form of miasmatic disease on the mountains this year, was a male who had worked daily in the valley, and doubtless contracted the disease there, and not upon the hill-tops."

The following letter from Samuel E. Gale, Esq., of Pine Island, N. Y., was written in reply to my inquiries upon the insalubrity of the Drowned Lands: —

"About forty-five years ago we derived considerable benefit from an improved drainage, the effect of cutting a canal lower than the old bed of the Wallkill at Hampton, and a small portion of these lands was redeemed and made tillable, demonstrating the fact that a system of perfect drainage is all that is required to make this the strongest soil, also the most productive of any in either of the States in which it is located. Previous to the cutting of this channel these lands were entirely under water for from three to four months each year, and were productive of nothing but wild grass and weeds of no value, and unfit for use. Not only would perfect drainage be a benefit to the soil, but I think it would have a good effect upon the health of the residents upon and around the lands. For the past forty-five years, chills and fever have prevailed in summer, making it almost impossible for strangers to escape the dreaded disease. I notice the percentage is far greater here on the Islands than on the hilly districts of Orange and Sussex. Although the freshets are not so great or of as long continuance as before the cutting of the canal, yet every spring and fall these lands are overflowed, and our cross-roads almost impassable by reason of being for a week or ten days from six to thirty-six inches under water. Last season, while the dry weather ruined all the hay crops on uplands, our redeemed Drowned Lands were covered with a heavy burden of good grass. A freshet came before the people had time to secure the grass, rendering it impossible to get on the lands, and thus nine tenths of the crop was destroyed. These are facts in regard to the Drowned Lands which any resident near them will corroborate."

This statement of my friend is like many others I have heard respecting the district we are now speaking of. Persons are frequently met who reside in such districts, and who insist that they are not unhealthy; this is mainly due to prejudice or to an unwillingness to speak evil of the place where

they live. I have seen many mill-ponds, and other ponds of stagnant water, about which no malarial disease was observed, but most, if not all, the cases were in a district where sulphate of iron or sulphate of alumina was always to be found in the water, and it is probable these substances would prevent the formation of miasmatic poison. The same exemption from intermittents occurs along our cedar-swamps, where the presence of some antiseptic in the wood, or some other cause, prevents that rapid decomposition which ordinarily goes on in or near stagnant water. Some portions of the Drowned Lands were formerly covered with a growth of white cedar. But with all the exceptions and qualifications that can be made, the fact remains well-sustained that these Drowned Lands are the cause of much sickness, suffering, and loss.

If looked at simply as a matter of business, it would seem as if the owners of these lands would have them drained at once. The losses of a single year would be enough to meet the whole expense, but people who are yearly subject to losses of this kind, and who every year suffer from chills and fever, are not usually very thrifty or energetic. Neither is it easy to get a large body of property-owners to agree upon any plan for executing or paying for a work of this kind. At present the laws only provide for assessing the expenses of drainage upon the lands drained, making no account of the benefits to adjacent lands, or of the still greater benefits to the whole community which arise from a removal of the causes of sickness and death.

We have a general drainage law in operation in New Jersey, and some valuable work is being done under it, but it is not all that is needed. And there is no influence so powerful in our country as that which should be wielded by this Association in this cause. Through it the authorities can be induced to authorize the preparation of the proper surveys, plans, and estimates for drainage work, to state the sanitary benefits to be derived by the public from such works, and to recommend that proper credit be advanced for paying for work before the taxes are collected. Were this done, the improvement we have here discussed, and many others of the same character, could soon be set in operation, and the resulting benefits would not be long delayed.

A REPORT ON THE SANITARY RELATIONS OF DRAINAGE AND WATER-SUPPLY IN NORTH CAROLINA AND THE SOUTH ATLANTIC STATES, AS AFFECTED BY TOPOGRAPHICAL AND GEOLOGICAL CONDITIONS.

By PROFESSOR W. C. KERR,

State Geologist of North Carolina.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 10, 1875.

In the discussion of this subject the most important points are, obviously, 1st, The Rain-fall; 2d, The Topography; and 3d, The Geology, involving chiefly the departments of lithology and stratigraphy.

The annual rain-fall in North Carolina has been commonly set down at about forty-five inches, a result deduced from observations collected by the Smithsonian Institution. But this figure is too low, except for the middle region of the State, the amount both for the coast region and the mountains being considerably higher, so as to lift the average for the whole State to more than fifty inches, as is shown in the Geological Report just published. So that, making a reasonable deduction for the amount of loss by evaporation, there will remain not less than fifteen inches to be disposed of by drainage, an amount equal to the entire precipitation of some of the most populous regions of the earth. A considerable part of this passes directly into the streams, and is disposed of by the system of superficial drainage; but a large proportion of it enters the subterraneous circulation and feeds the sources of wells and springs "which run among the hills." Now it is this last item, this underground circulation, which most concerns the sanitarian with us. The disposition of these waters, — whether, on the one hand, they remain long on, or near the surface, becoming stagnant and polluted sources of malarial exhalations, or percolate slowly through a close and clayey texture of soil and subsoil, or massive rock, thus furnishing one of the essential conditions of putrefactive fermentation of organic matters, and keeping the soil in a state of unhealthy damp and chill, or, on the other hand, pass through an open and permeable soil or rock texture, reaching at once the cooler and purer depths, where are found neither organic matter nor a temperature favorable to its decay; whether the one or the other of these conditions obtains, determines, so far as the present subject is concerned, whether a given region or locality is to be considered salubrious or insalubrious. And these relations are obviously controlled by the topography, or the forms of surface and the geology, or the nature and structure of the soils, earth, and rocks. And it is obvious enough that when the question of water supply is broached, the same underlying conditions are equally potent and determinant. This cannot be put in a stronger light

than by a reference to the subject of artesian wells. And to those who have attended to the discussions and investigations with regard to the water supply of London or Paris, for example, no stronger illustration of the point can be cited. In the former case, the early settlements of population, when only the simplest means of obtaining water by means of springs and shallow wells were known, followed with notable accuracy the irregular patches of the superficial Quaternary gravel beds, so that the geology beneath can be traced by merely noting the more ancient groups of dwellings, suburbs, and villages which have been more recently fused into one vast city by the discovery of the artesian well, which has made it possible to overcome the untoward geological conditions of the surface and draw upon the deeper sources of water supply, — first the tertiary gravels at the depth of one hundred feet and upwards; and when this stratum was exhausted, the chalk-beds at the depth of several hundred feet. And the water supply of Paris has a similar history; a considerable part of its supplies are at length drawn from permeable geological strata lying at the depth of 2,000 and 2,500 feet beneath the city, and deriving its waters from a precipitation which occurs at their outcrop, one hundred miles distant. And the history of the successive contamination, as well as exhaustion, of the successive water-bearing strata beneath these old seats of population, are full of instruction as well as warning for us.

Let us, then, consider, first, and of course very briefly, the general features of the topography of North Carolina. I have hastily and rudely sketched the main points, on which it is justifiable to detain you, on the map before you. You will observe, in the first place, that there is a gradual rise in the surface from the seaboard toward the west, at first very slow, but presently more rapid, until an elevation of three thousand feet and upwards is attained along the line of the Blue Ridge, which elevation is preserved, and even exceeded, as you proceed west, beyond that escarpment of the mountainous plateau, which extends in that direction nearly two hundred miles further. The second point is that the drainage surface of the State is divided by that chain into two areas, one delivering its surplus waters along the Atlantic coast, and the other into the Mississippi, through the channels of the Tennessee and the Ohio. The Blue Ridge is thus the great divide, or dominant water-shed in this State, which it is not in Virginia, the Alleghanies taking this junction in that State, both the James and the Potomac carrying their currents across that chain into the Atlantic. And it is worthy of incidental mention here, that this position of the water-shed is notable and singular, from the fact that the more western range of the Smoky Mountains is much the more massive and lofty chain (averaging at least 1,000 feet higher), so that in fact the tilt of this plateau is really towards the Atlantic, as shown in the profile. How this curious piece of topography came about, the geological account of its genesis, it is not now in point to discuss. In the third place, these two great drainage areas are subdivided by heavy transverse mountain chains in one case, and by broad or sharp swells, or ridges, rising sometimes to the dignity of mountains in the other; into deep trough or broad shallow valleys, constituting a system

of subordinate, independent drainage areas whose channels take the shortest and steepest courses from the Blue Ridge, to the northwest in the one case, towards the great Appalachian Valley of Virginia and Tennessee; and in the other towards the Atlantic. And fourthly, the last-named condition of things is modified, as to the Atlantic drainage, by the eastward protrusion of three ridges or swells, —spurs, in fact, of the Blue Ridge, — which extend far out into the Piedmont and middle region, in one case more than a hundred miles, with an elevation at its eastern limit of a thousand feet above the sea; and by this means a part of the eastward drainage (of the middle region) is thrown off exceptionally to the north and the south.

So much for the general and broader features of the topography. But there are several particulars of sufficient importance to deserve a moment's attention. One is that these transverse, connecting spurs or ridges of the mountain plateau are generally higher than the main chains; and the greatest absolute elevation, the summit peak of the whole system, is found on one of these cross chains; so that, in fact, the simplest conception of the subject is that which makes the whole system one broad-backed rugged range, having the Blue Ridge for its eastern escarpment, and the Smoky Chain the western. A second point is that the drainage centre — the radial and dominant part of the region — is situated neither at nor near the highest point, nor on the dominant chain, the Smoky, nor yet near the centre of the system, but, quite eccentrically and abnormally, on the Blue Ridge, and at the narrowest part of the whole plateau; and from this point (the Grandfather Mountain, nearly 6,000 feet high,) eight considerable *rivers* radiate to all points of the compass, three of them affluents of the Tennessee, one of the Ohio, and four flowing more directly to the Atlantic.

A third point is, that the eastern margin of the State is thrust out more than one hundred miles beyond the normal trend-line of the Atlantic coast, thus giving to the State an exceptionally broad seaboard champaign, and inclosing a large area (more than three thousand square miles) of salt water surface, in the form of shallow sounds and bays. The fourth point is, that this great coast-ward plain is subdivided into a series of unique drainage areas, which quite uniformly consist of two very unequal north and south slopes, the north slope being always much the larger in area and carrying most of the river tributaries, while the south slope is quite narrow and steep; so that, in general, the swamps and marshes lie on the left bank of the rivers, and the great roads and the towns on the right bank.

A fifth feature is the existence in this region of great swamps, often of hundreds of square miles in area, and very peculiar in their structure and character, being situated at the crown of the broad swells or water-sheds that separate the great rivers and sounds, being, in fact, peat swamps, characterized by a cypress and juniper growth, a considerable depth of partly decayed wood (incipient lignite) and other vegetable matter, and with generally one or more fresh-water lakes in the centre, from which streams radiate in all directions.

A sixth point is the occurrence of a continuous chain of narrow sand islands bordering the whole Atlantic coast for two hundred miles. And

the last point to which I call your attention, is, that the whole system of topography of the State, mountain and plain, in all its extent and complexity, is a passable instance of atmospheric sculpture on a great scale, executed, of course, in subordination to certain great geologic forces and preëstablished conditions, yet so that every swell, and knob, and ridge, and peak, and mountain chain owes its existence, its form, position, magnitude and direction, to meteoric agencies; so that we have here an example of erosion probably unparalleled, in extent and magnitude of results, anywhere else on the earth's surface; and that this may not seem extravagant to you, I will say here, in anticipation of the proper connection of the statement, that the play of these forces has been uninterrupted from the remotest geological ages, nearly the whole of this territory, except the Atlantic champaign, belonging to the lowest horizon.

And this brings us, by a necessary connection of thought, to the second division of the subject, the geology as related to drainage and water-supply, this relation taking effect in part as intimated, mediately through the topography. The important points are, therefore, of three classes, topographical, stratigraphical, and lithological. As to the latter point, the middle and western portions of the State belong geologically, as just intimated, to the primary or crystalline systems, but they are bedded rocks, slaty, schistose, gneissoid in structure. As to the second point the stratigraphy is controlled like that of all the rock-systems of the Atlantic side of the continent, by the great Appalachian axis, the rocks being conformable in strike to that ancient line of fracture and uplift, and they are tilted (generally to the east) at a high angle. Let me emphasize the important points; namely, that the rocks are crystalline or granitoid, are bedded and are highly inclined, — stand on their edges. In the eastern section, the rocks are nearly horizontal in position, having a slight inclination coastward, and they are lithologically quite different from those just described. We have first the superficial gravels and sand beds of the Quaternary, of variable thickness, from eight or ten feet to twenty or thirty and upwards. Beneath this come the uncompacted sand and clay and marl beds of the middle Tertiary, also of very variable but generally a little greater thickness than the preceding, rising in some cases to fifty feet and more, and in some localities, as the middle coast region, between the Neuse and Cape Fear, being either entirely absent, or occurring in thin and unconnected patches. Next in order is the lower Tertiary, or Eocene, which is a thin bed of limestone, generally more or less compact, but frequently a soft and porous shell-rock, or friable calcareous sandstone; and beneath this is the green sand of the Cretaceous, which is generally too deep-lying to affect the circulation of the drainage or potable waters, except in one limited tract. This is generally a partially compacted sandstone, with a sufficient admixture of clay to render it almost impermeable, so that it limits the percolation of the surface waters, which are thrown off from its surface, either directly into the streams, or in the form of springs.

Returning now, in the light of these geological facts to consider, for a moment the first point, their relation to the topography above presented, we

observe in the first place that the courses of the great river valleys, the mountain basins or troughs, which carry off the waters from the Appalachian axis, are transverse to the outcropping edges, or to the strike of the formations, while their tributaries, the smaller streams, follow the outcrops. The exceptional case in which the waters of the Piedmont region are partially deflected, so that the primary valleys have a course nearly parallel to the Blue Ridge for a considerable distance, is found to be due to a transverse axis of uplift having a direction nearly east and west, and occurring after the Triassic age, as shown by the anticlinal dip of this formation on the two sides of this axis; and to this same comparatively recent upheaval is also due the remarkable projection of the North Carolina coast, already adverted to.

We are now in possession of all the facts which are necessary to a complete conception of the whole subject of drainage and water-supply in North Carolina. To recapitulate briefly, so as to bring the prominent and controlling points into our view, we have the surface of the State divided by the great Appalachian uplift, the Blue Ridge *divide*, of about 3,000 feet elevation, into two very unequal and dissimilar drainage areas or slopes, one of some 10,000 square miles, with a rapid descent to the northwest of 1,500 feet in 40 miles, or about 40 feet to the mile, the water-courses lying transverse to the strike of the almost vertical rock strata, in deep troughs, or basins, which they have eroded for themselves, and issuing in the great Appalachian valley through enormous gorges, or cañons of 3,000 and 4,000 feet in the great Smoky Chain; the other a long slope of 240 miles, descending first from the crest of the Blue Ridge by a sudden and almost vertical plunge of 1,500 feet, then after a rapid descent "of fifteen to twenty feet to the mile, across a narrow and rugged" piedmont, taking a gentle inclination of about eight feet to the mile still across the upturned edges of the metamorphic rocks, until the great eastern champaign is reached, at the distance of 150 miles from the Blue Ridge, after which it descends 100 miles to the shore, with a fall of only two feet per mile: this last area, presenting at the surface nearly horizontal deposits of Quaternary gravels, underlaid, first by Miocene sands, clays, and marls, and then by more or less compacted, but generally permeable strata of Eocene limestone, at the base of which, and only occasionally outcropping, lie the Cretaceous green sands.

The average elevation of the State is about 640 feet. The amount of water to be disposed of by drainage is about 50,000,000,000 of tons, nearly equally distributed through the twelve months of the year. And I will state here, as affecting the movements and diffusion of this mass of water, that the mean annual temperature of the State is 59°, the winter mean 41°, and the average minimum temperature of winter is 15°, and this is rarely reached, and the ground is rarely frozen deeper than two or three inches. So that there are practically no climatic obstacles to the free movement of the waters.

Consequently, it is evident that, so far as the western and middle regions of the State are concerned, the conditions for rapid percolation and complete drainage could not be improved, and springs and wells abound everywhere. There is not a lake or pond in all those regions except it be artifi-

cial. And there is no possibility of the accumulation of stagnant water, unless by human act or fault. And I need hardly say that the geological facts mentioned, the prevalence of crystalline, metamorphic rocks, secures the purity of potable waters. New York and Boston are happy in the possession of such granitic water basins in their Croton and Cochituate. Of course where these rocks are locally mineral bearing, pyritiferous, for example, the waters will be mineralized, — will contain sulphur, iron, alum, and sometimes potassa, soda, magnesia, etc. Such springs are not uncommon in that region. And limestone water is found with calcareous rocks, but these are only too rare, and occupy very limited areas. As for the eastern plain all the conditions both of drainage and water-supply are here very diverse. There are first, the broad flat swells which form the river divides, these are capped for the most part with quaternary deposits, and in some sections also with several feet of loose marine sands, or flattened dunes. On such ridges, which constitute a considerable proportion of the eastern plain, percolation of surface water is unobstructed, and well and spring waters of fair quality are everywhere accessible. But in the flatter and lower portions or benches, and about the sources of the tributary streams, where the superficial sands or earths are of a diminished thickness, and along the south banks of the rivers, the wells often penetrate the beds of miocene marl, and then the waters contain lime, iron, alum, and often organic matter, and are unpleasant of taste, although apparently not generally unwholesome. In the region between the lower Neuse and Cape Fear, where the eocene limestone is quite near the surface, often cropping out, there is a very notable system of underground circulation, the subterraneous waters having effected free communication from stream to stream, and from one "natural well," or "sink-hole," or pond to another, these being formed by the caving in of the superficial earth and sand when the sheet of limestone has been dissolved. These subterranean streams often issue in springs of great volume, discharging thousands of gallons per minute, and are frequently tapped in sinking wells, as in the city of Newbern on the Neuse. The general character of these waters will be best exhibited by means of a few analyses.

	No. 1.	No. 2.	No. 3.
Org. and Vol. Matter	5.16	5.79	5.07
Silicic Acid	1.65	3.76	7.87
Oxide of Iron and Alumina	3.80	0.86	0.58
Lime	4.80	1.17	4.08
Magnesia	0.49	0.06	0.93
Sulphuric Acid	0.25	1.23	0.93
Chlorine	0.92	0.18	2.79
Sodium	11.91	7.26	2.68
Average of the three wells			19.86

Omitting the volatile and organic matter, the larger part of which is evidently to be set down as carbonic acid, combined with the lime, etc., the

solid matters here, twelve, seven, and twenty, leave these samples far within the limit of potable and wholesome waters. And, owing to the depth of their circulation, their temperature is about 60°, corresponding to the isothermal of the region.

There remain to be mentioned three sorts of regions, of local and exceptional character; one of which is the "bottoms," or flood-plains found in considerable areas along the lower reaches of all the great rivers which traverse the eastern Champaign. These are liable to annual, or more frequent overflow; they are low and flat and covered with heavy forests, generally of cypress, gum, etc., and are frequently submerged to the depth of several feet, or even fathoms, and to the extent of several miles of breadth, and occasionally for two or three weeks together, generally in winter or spring.

The neighborhoods of such river swamps constitute the unhealthy tracts, which have given, quite unreasonably, their bad reputation to the whole region. Another character of territory referred to is the peat-swamp, already described in part. Nearly the whole of the large tract between the two great sounds, Albemarle and Pamplico, belongs to this description of territory, as well as the great Dismal Swamp to the north of Albemarle, and several others, quite as large, lying to the south of Pamplico. Singular as it may seem, the waters flowing out, often with a rapid current, from these elevated swamps, or from the lakes in their centre, are very pure and wholesome, containing almost no impurities except the humous acids which give them a brown color. These waters, from the Dismal and other swamps, are preferred by sea-going vessels before all others. And the swamps themselves are eminently free from malaria, and necessarily so, as one of the essential conditions of putrefactive decay of organic matter is entirely wanting. And accordingly the dwellers of these swamps are a hardy and long-lived people, and the "oldest inhabitant" is quite as likely to be found here, on the frequent inclosed hummock and dry ridges, as on the western plateau. One of the most productive and prosperous sections of the State, Hyde County, which shows the largest aggregate annual yield of corn, as well as the largest average per acre, I believe, of any county in the United States, lies in the middle of such a swamp; and the larger part of its wealth and population are found on a low flat ridge six to eight feet above tide, which fringes the central lake, Mattamuskeet, around which, on an elliptical street of some twenty miles, the dwellings are collected, in a scattered linear village, the farms running back from one to two miles into the surrounding swamp. For domestic purposes the inhabitants have recourse to the brown, wine-colored waters of the lake, and to rain-water, which they collect in huge cypress troughs, or "dug-outs," arranged under the eaves of their buildings.

Another very unique topographical feature of the region is *The Banks*, which it is worth while to mention here in order to a complete view of the subject. These are a chain of narrow linear islands, which skirt the whole coast around, a distance of more than two hundred miles, walling off for the most part a parallel series of narrow and shallow sounds. These islands are composed of beach-sand, driven shoreward by the tides and winds.

They are generally half a mile or less in breadth, but occasionally widen out to one and even two miles; and from an average elevation of their crests of ten to fifteen feet, they often rise to a height of thirty, fifty, and even one hundred feet and more. They are in fact *sand-dunes*, with their steeper slope landwards, and are in a state of continual flux, moving in general slowly toward and into the sounds, which are thus slowly silting up, and are changed in form and position and dimensions by every great Atlantic storm, new inlets being formed continually and old ones filled up. And this process of addition to the coast has been going on for ages, old sand-dunes, parallel to the present, being still traceable far inland. And it may be worth while to add that the process is likely to continue for ages to come, until the coast of this State shall be carried far out into the Atlantic, to the great sub-oceanic Gulf Stream wall. And the process is the more rapid, and has been, from the fact that the material for these dunes is derived not only from the territory of North Carolina, but the whole coast is laid under contribution, the sands being brought down from the north by the shoreward Arctic current, while those from the south are brought up by the Gulf Stream, the two meeting off Hatteras and mingling their freight, which in the conflict of these currents, exaggerated by storms, are swept now north, now south, at each movement throwing a part of their burden landward with every tide. It may seem singular but is readily explicable that there are frequent fresh-water ponds and lakes in these islands, and that surrounded by salt water, and the whole mass of them being permeable sands, fresh water is found readily everywhere by the inhabitants; and the wild horses, called "bank ponies," — which constitute the chief product and export of these islands, — easily procure it by excavating with their hoofs.

Such is a very general view of the natural conditions of drainage and water-supply in North Carolina; and I have, in the title of this paper, extended the description much wider, as these conditions are repeated, with no important variations, in Virginia, South Carolina, and Georgia. You will see that these conditions are, for the most part, highly favorable to human health. And it will be found, by reference to the comparative tables recently published by the President of this Association, that in fact the State of North Carolina stands above the average in respect to general salubrity. That it does not stand much higher is due, among other things not connected with the matter of the present discussion, to the fact that sanitary science is wholly unknown among us; and so far from having a system of sanitary laws, commissioners, and regulations, as in England, for example, for every town, and as in most of the populous districts of this country, cities especially, the only provisions in our statute book, outside of the regulations of quarantine, etc., for a few seaport towns, are contained in a single paragraph, relating to the powers of county and town commissioners to adopt measures for the arrest of a flagrant epidemic, like cholera or yellow fever. Our physicians are of course well aware of the greater prevalence of certain types of disease in tracts and zones in which, for example, there happens to be a soil or subsoil of unusually close and impermeable texture, and they are well aware also of the importance in a sanitary view, of a

proper collocation and arrangement of wells and buildings with reference to stables, privies, etc., and other sources of pollution, especially in regions where the opposite conditions of soil obtain. But practically no attention is paid to such matters. Dwellings are still located as from the beginning mainly with simple reference to convenience of water-supply. And so of course we have typhoid and diphtheria even in the tops of our mountains, where such diseases ought to be utterly unknown. I have met several cases of both these diseases there the past summer. And I mention incidentally also, that I have lately met in the same region, as every summer, a malignant disease, not of zymotic origin, which with us is confined to the higher mountains, known as the milk sickness, having been traced very directly to the use of milk, and also locally, to certain well known tracts of wild pasturage, but further than this, quite mysterious in its origin.

That the State stands so well in the scale of average healthfulness, is evidently due wholly to natural conditions, and not at all to artificial or legal regulations.

SOIL DRAINAGE AND ATMOSPHERIC HUMIDITY.

BY SANFORD B. HUNT, M. D., NEWARK, N. J.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 10, 1875.

Propositions. — In the propagation of the Epidemic Zymotics there are three principal factors: —

I. The Epidemic Constitution of the Air.

II. A High *Relative* Humidity.

III. Soil Poison.

The withdrawal of either one of them will ordinarily paralyze the energies of the other two. There are exceptions.

The two first are uncontrollable in any considerable area, but when either or both of them are withdrawn by atmospheric changes, the disappearance of the epidemic proves their importance as agents and vehicles, without which soil poison cannot carry on the epidemic.

Again, remove the soil poison, and humidity and the epidemic constitution of the air become almost and generally entirely powerless for harm.

Soil poison, unlike the other causations, is always under the control of human agencies.

Finally, a dry atmosphere is a healthful atmosphere, and opposed to the propagation of all zymotic diseases. The term "high dew-point" is used in this paper as the synonym of high *relative* humidity, without reference to temperature.

I find that an extended paper which I had prepared for this occasion has too many illustrations of a single point in what may be called the physical geography of hygiene, and partly in deference to the time of the Association, and partly because one idea ought to be able to impress itself without many words before such a body as this, I have thrown away much that I have written, and shall be brief.

In 1854 occurred a fearful epidemic of cholera at Suspension Bridge, near Niagara Falls. It was attended by a tropical dew-point, as high as 80° and even 82°, — fatal dew-points in yellow fever epidemics. The pestilence was the most terrific, violent, and sudden in fatality I have ever witnessed. So long as the high humidity, the almost saturation of the air with vapor at a high temperature, continued, the deaths only grew less frequent because the people fled in panic. On the fifth day, or the night of that day, the dew-point fell suddenly from 80° to 56,° and the epidemic stopped. It was the work of an hour. There were no new cases, and the sick convalesced.

The conclusion would be that the high dew-point was the master of the

situation, the controlling integer of death. I have no doubt it was so far as that locality was concerned. But that does not explain why only two miles away at Niagara Falls, upon the same level table-land, having the same temperature, the same humidity, and, of course, the same epidemic constitution of the atmosphere and a larger population, there were no cases of cholera at all. Evidently the dew-point was only one of the factors, and the one purpose of this paper is to assign to it its proper relations, and I consider them very important as they touch upon soil poisons and drainage. But I must not be considered as quoting a phenomenon in the matter at Suspension Bridge. In the city of Buffalo I closely followed the dew-point during a prolonged epidemic of cholera, lasting many weeks during the same year, 1854, and as the dew-point went up, so did the death-rate of the succeeding day. At that time I gave undue importance to my own factor. I was only a specialist on heat and humidity in their relations to disease, and read a paper to the American Medical Association the next year, which, while it is the naked truth, it is so naked that I am now ashamed of it, except as it was honest in statement and valuable in fact. It is necessary, therefore, to trace the independent effects of heat and humidity, dissociated from other causes of disease.

It is a vapor bath, producing languor and nervous depression, and therefore opening the system to attack from any other cause. I can illustrate by contrast. On that night when the dew-point fell and the blessed seals which close the pestilence were placed, I, worn and fatigued with days and nights of vigil and sense of peril, suddenly found myself, elate and alert, lifted up into a new atmosphere, and so were my patients. The moral effect, the new courage, the nerve to fight, the hope that usurped a dull, dumb terror, was visible at every bedside, and when sanitary science comes to its best, the moral and mental treatment, even of tangible physical disease, will take its place as something most important.

But to return. This same relative humidity, only two miles away, did no special harm. The pestilence under my supervision was confined to an area of a few hundred acres. It was fenced in by health on every side, and the barrier could have been drawn on the map. Evidently the causes were local and in the soil, or in contagion. The epidemic constitution of the atmosphere was the same everywhere. It was a cholera year, but the cholera could not prevail without the help of heat and humidity. Dr. Barton, that venerable man of New Orleans, had taught us even then that yellow fever stops when the dew-point falls below sixty degrees, frost or no frost. Its contagion ceases. It must be cooked at a certain temperature and in a certain amount of moisture, in order to be active.

At the time of this Suspension-Bridge epidemic, the bridge was in process of construction. A great crowd of common laborers had been gathered together, and were camped in shanties on both the American and the Canada sides. The earth all around was upturned by the bridge construction and the opening of streets. The natural drainage was good, as it well might be on a cliff of limestone, lying in level strata, two hundred feet above the river below, but that had been disturbed by excavations, and every

old soil poison was upturned to a steaming atmosphere. There was no wind, there was intense heat, tropical showers, abundant mud, and no drainage. The water lay upon the surface, and all that was bad in the soil was floated into the atmosphere and breathed into the lungs of the people, while in the atmosphere itself was the poison of cholera, in the contact with the sick was contagion, and in the foulness of the shanties was crowd-poison. And to all these fatalities came the fearful agent and vehicle of a high dew-point. When it departed, the other integers of death waited to take other forms of disease to which a low temperature, with a comparatively high humidity, is competent.

And here let me suggest that it is already possible to make a near classification between atmospheric poisons as they are, hot or cold, and as they come from the epidemic constitution of the atmosphere or from soil poisons. The poisons which depend upon heat and humidity for their power produce sthenic diseases, and are rapid in their action. The diseases which are created by cold humidity are slower, as a rule, and are represented by a range of diseases of the fibrous and serous membranes, which ought all to be classed as rheumatisms, including pleurisies and cerebro-spinal meningitis. Pervading both, and creating an infinite variety of shades of disease, are the poisons of the soil and the body which develop the typhoid tendency. The element of humidity is requisite in all. Job was right in saying, that "affliction cometh not forth of the dust," but he was only referring to something else when he added, "neither doth trouble spring out of the ground." He probably intended only the arid soil of Palestine, and he was more acquainted with grief than he was with sewer gases.

There is a point in the matter of the upturning of soil which I must briefly mention. It is this: mere shallow surface upturning, like that of the plough or the spade, is not traceably a cause of disease if, indeed, it does not impart health to the air. Going deeper down into soil which has laid for centuries, we find strange seeds, new plants coming from them full of life as the wheat taken from the tombs of Egyptian mummies, and as I believe, we find new fomites of disease, not specific, perhaps, but baleful. Dr. Frank H. Hambleton traced a long line of cholera cases, in a pure and healthy neighborhood, lying to the leeward side of a street excavation in clean soil where water-pipes were to be laid. This was on Ellicott Street in Buffalo, in 1852. Yet it was as clean a soil as was ever seen. Perhaps the explanation is that in the farm lands the earth has been oxydized by previous upturning and exposure to the sun and air. The *first* upturnings on the prairies of the West are usually followed by chills and fever.

I have taken this one epidemic of cholera twenty years ago only as a text for a lesson which has been confirmed by subsequent reading and experience. Three things are settled in my mind. The factors of cholera are the epidemic constitution of the air of which we know nothing and which we cannot help. Second, a high heat and humidity which is not preventable over any large area and cannot be managed in practical hygiene. Third, soil poison, without which either of the others are powerless and which we

can control. And the intelligent correlation of these three factors will control any of the great and sweeping epidemics, and largely control even the strictly contagious disorders. Starvation diseases are in another category. They are to be cured by intelligent feeding or by fixing the system so that it can be fed. The latter task belongs to a noble profession, whose usefulness will last as long as disease and death endure, and who, in the long run, lose every case. He who fights death does not win.

I had intended in the longer paper which I first desired to present, to describe the physical geography of a number of epidemics in which the trouble came out of the ground and should be referred to our friends the civil engineers, who are of the earth earthy. But one is the same as the rest, and many a time in the Army when the engineer and myself have ridden forward to lay out the camp, these ideas have verified themselves and found practical application. I turn now to a contrast: —

There is a little island which God seems to have set as a sample of what climate, drainage, and sewerage ought to be. It is about half as large as Staten Island and a hundred times as healthy. It lies on the verge of the trade-winds, sweet little showers sweep over it daily and all the people use umbrellas as canes ; the temperature averages 80°, and the dew-point is constantly high, but the people are not languid to any degree unusual to those to whom constant bodily comfort is the rule. All is cleanly and orderly. Religion flourishes and the social life is not only warm and cordial but refined and intelligent. It has a population of about 14,000 people, white and black. It has not a running stream, nor well, nor spring, yet it has an abundant supply of purest water, fresh from the sky and uncontaminated by any taint of earth, except that as the roofs are kept whitewashed the nitric acid of the rain is neutralized before it reaches the cistern. It is a long, low-lying, horseshoe shaped little continent of soft limestone and coralline rock, six hundred miles from nearest land, and great sewers of ocean water flush through beneath the rocky soil and on the tide level; to these go all the refuse of the island. The porous rock of the surface is all one continuous blind drain connecting with the caves of water which ebb and flow with every tide beneath. And the cleanliness which God has given to this little oasis in the ocean is found in the scattered houses which nestle under the shelter of the low hills, their white roofs gleaming against orange and lemon groves, the property lines marked by banana plants, the hedges resplendent with oleanders and a thousand flowers. The roads are perfection and the houses comfort. If I were to venture to instruct our colleagues the civil engineers, I would tell them to go and see and imitate what God hath wrought in the island of Bermuda.

And now allow me to mention some apparent exceptions to this associated tirade of causations. In Bermuda we find a high humid heat compatible with health. The epidemic constitution of the air is practically nothing, in its isolation in the sea, yet it has known a terrible epidemic of yellow fever, many years ago. The contagion, which was brought from the West Indies, was an animal poison, and to be grouped with the soil poisons. It had its ally in humid heat.

I mention this by way of contrast with the epidemic of the same disease a few years since at San Antonio, Texas, located in a region which at the season when the epidemic came is absolutely desiccated by the dry south wind of Western Texas. So dry is the atmosphere that intense heats, as high as 90° and higher, do not interfere with active midday exercise, and the race of men bred there is as wiry and enduring as Arabs. Yet in that dry atmosphere the epidemic of 1867 was very fatal. It seems to have had nothing but contagion for its cause and dry heat for its assistant. If the town was dirty, as it always is in certain quarters, the dirt had been dried down to dust. There was no epidemic constitution there. The disease arrived by stage-coach and with caravans of goods.

The epidemic of yellow fever of the same year at Shreveport, La., was imported by steamer, and could have been prevented by quarantine. But when it got there it found all the conditions, humid heat and an undrained and uncleanly town. Small-pox would have been less fatal, owing only to vaccination and ability to isolate patients.

These three latter instances, those of Bermuda, San Antonio, and Shreveport, might lead to some question as to whether the epidemic constitution has any place as a factor in our argument; but there are so many instances where whole cities have been so suddenly smitten by plague that we must believe that there is such a phenomenon. Let the hay-fever of men and the epizootic of horses be the sufficient witnesses. And graver epidemics travel long distances, passing over healthy sites and crowded cities, and halting only when they find their indus of soil poison and humid heat.

I have only mentioned the too constant alliance between soil poisons and cold humidity. To the class of diseases which they produce and which flourish most in the cold season, only the soil poison, as it comes moist and cold from the reeking sewer or the foulness of the cesspool, is necessary. They need no heat, no epidemic constitution.

I hope that I have succeeded in my attempt to correlate these three great forces of death without assigning to either undue proportions. If I have accomplished that, the argument will extend to almost the whole range of preventable diseases, whether of cold or of hot causation; but of these three the greatest is soil poison, because it is the most active, omnipresent, and the most preventable.

SEWER-GAS AS A CAUSE OF DIPHTHERIA, MEMBRANOUS CROUP, AND TYPHO-MALARIAL DISEASES.

By PROFESSOR H. R. NOEL, M. D., *Baltimore.*

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

THE writer does not propose in this paper to discuss the essential nature of diphtheria, or of membranous croup, or of typho-malarial fevers. Whether these diseases depend upon specific animal or vegetable germs, as asserted by the advocates of the "Germ Theory of Contagious Diseases," or whether they are mere vibrations in the vital dynamics, a sort of positive and negative relationship of vital force or nerve force, we need not now discuss. We place diphtheria and typho-malarial fevers together because of their common element of *low vital dynamics*, and we have added membranous croup, because recent discussions and investigations place it as a congener of diphtheria, and because in our own recent experience we have seen the three forms of disease depend apparently upon a common cause, *i. e.,* sewer-gas. The marked characteristic of this class of troubles, is depressed vitality, lowered vital force; an abstraction, often insidiously slow, of the muscular nerve and brain force of the patient.

It will be seen that we have ignored the distinction between typhus and typhoid fevers, and have put these fevers under the name of typho-malarial, — a classification which many shrewd practitioners prefer. These fevers, whether the result of marsh miasm, animal miasm, sewer gas, or exhalations from cesspools, have the one element of depression of vital force, which in many instances precedes the attack by days, weeks, and even months. This stage seems one of gradual poisoning, — slow infection, — until at last the resistance of the system ceases, or becomes so much weakened that we have either a sudden explosion, with violent but transient phenomena, and sudden collapse, or we have the phenomena of sure and steady advance of the poisoning, and as certain ebbing away of resisting power; until, by almost imperceptible gradations, the wreck is completed, and the life is lost. It matters not, so far as the final result is concerned, whether this miasm or gas be the primary or secondary cause; whether it be the agent *per se*, potential in itself, or be but the caterer for myriads of bacteria, or microzymes, micrococci, etc., which inhabit the human body, or whether it brings upon us these very germs themselves; the one fact is to us patent, that sanitary science must deal with the gas or miasm as a whole, and leave to the microscopist the possible chance of its ultimate analysis, into a swarm of living organisms.

What, then, is the action of sewer-gas? A question difficult of solution; than which none other is more fraught with contradictions, and more inextricably interwoven with arrays of apparent facts; yet a subtle analysis of

this confusion must one day give us the elucidation, and place plainly before the public the solution of the seemingly strange and, at present, inexplicable anomalies.

A household is decimated by typhoid fever; a sink or privy, from which arises a peculiar and penetrating odor, is charged as the *fons et origo mali*, and yet the "night-men" remove every vestige of contents, and not one of these night-men retains, or bears to his home the seeds of the disease. But immediately the disease is arrested, and claims no more victims in this family. Is it possible that a small infection, long repeated, has at last, like water dropping, worn away the family's power of further resistance? To these questions we cannot at present give a definite reply, or a satisfactory and comprehensive generalization; but we can adduce facts which point to the gradual and slow reception of minute doses of the poison as being ultimately disastrous indeed, and yet so very obscure and subtle that the cause well-nigh escaped detection. But we do not believe that this subtle influence is by any means measured, or its victims enumerated, when placed in the three divisions we have chosen; there are many other maladies upon which this malign influence stamps its mark, and the slow, tedious recoveries, the often strange and inexplicable violence of ordinarily mild diseases, the frequent intractable forms of infantile troubles point, in many carefully watched cases, to an impression received prior to the acknowledged onset of the disease, and to an acquired vulnerability in the child, which induced a crisis so sudden that the attendant — uninformed as regards antecedents — was powerless to avert the fatal culmination.

In illustration of the above we will instance cases of scarlatina and diphtheria.[1]

[1] April, 1875, had under treatment a family upon Fayette Street (No. 664), mother, father, and four children; residing in same house was another family with two children, making ten whites, with a colored servant as cook. Three of the children were often sick; two had marked and intractable enlargements of the glands of the neck; one of the mothers suffered from neuralgia, the other had constantly recurring bilious attacks. The last week in April, the servant was taken with a violent form of what appeared to be diphtheria, the glands of the neck and throat swollen, fever very high, delirium, partial paralysis; and on the third day well-marked diphtheritic membrane over the throat, and the case showed at once symptoms of the lowest type. She lingered for weeks but finally recovered; to our surprise after a few days, the skin peeling off in huge rolls, betrayed a scarlatinous element. Soon after her attack the whole household became involved, all six of the children were taken sick, and one of the ladies. Of the seven persons last seized three had scarlet fever well marked; four had diphtheria with swollen glands, etc., but no rash; and two out of the three who had scarlet fever, had also diphtheria, but of the eight persons sick, seven had well-marked evidences of diphtheria, and one only had scarlet fever without it, and this one was a child five months old; all were sick at the same time, — the cook preceding by a week. The room occupied by the cook as sleeping apartment was immediately in rear of the dining-room, and within fifteen steps of a sink or privy; from this privy there arose a most disagreeable and pervading odor, which was immediately recognized as a form of sewer-gas; in fact upon passing through the dining-room to see the cook, upon the first visit to her room, the condition was appreciated and the lady of the house warned most earnestly against it. The weather became warmer, and there was a delay in correcting this nuisance, and after several days a direct appeal was made to the Health Officer, who promptly corrected the trouble. But in this time as above stated seven others were taken down, and of these one died. There were here two noticeable facts: —

In the three divisions of disease we have selected, there has been one common element of causation, that is, exhalation from sinks or privies; in each division there has been the condition of slow poisoning to saturation; in each division there has been depressed vitality, and in each the characteristic feature of intractable persistence in spite of judicious medication. These three subdivisions of effects, of varied character from a common origin, have come under observation within a year; and they are by no means isolated cases; scarcely a week passes that we do not witness more or less of the same chronic poisoning in every-day experience; but here we

1st. The intractable glandular enlargements for weeks prior to the outbreak.

2d. The blending of diphtheria and of scarlatina, and the apparent division of the cases into the two distinct diseases, from a single source of excitation.

The colored cook evidently had a most severe case of diphtheritic scarlatina, as evidenced by the membranous trouble of the throat and subsequent desquamation. The family, charged with the exhalations from this privy, and exposed almost equally to the contagion, gave three cases of scarlet fever well-marked, and seven cases of diphtheritic trouble. But the consequences did not terminate with this record, for another servant, hired a few weeks afterwards, had an attack of obscure nature, and remained more or less complaining until the house was abandoned. One of the children, an infant of eight months who had apparently escaped with only slight trouble of glands and throat, suffered a very marked arrest of development of the bones of the cranium, and though removed to another street, has since died, of an unexplained attack of cholera infantum of three days' duration. The invasion was sudden and the collapse most complete; this in the month of October is certainly unusual, and points to a prior acquired vulnerability.

Membranous Croup. — Upon Lexington Street, in a square exactly parallel, — that is, in a corresponding block of the next street north, and bounded by the same cross streets, a similar arrangement of houses, sinks, and privies existed; here, also, intractable troubles arose, and in one family a child lingered for months with cholera infantum of a typho-malarial grade, and finally died of dropsy; in another family, membranous croup with marked lowering of the vital powers claimed one victim, and other cases of the same form of croup occurred. The two families lived in adjoining houses, and the source of trouble was identified as a sink or privy, and only by direct appeal to the Health Officer could the nuisance be abated. The odor from the privy was in these cases clearly perceptible.

Typho-malarial Fever. — In a family now living upon Orleans Street, East Baltimore, there have within the last two months occurred three cases of marked typho-malarial fevers, — one of the cases has recently culminated in an acute miliary tuberculosis, consecutive upon an eight weeks' attack of typhoid fever. The history is as follows: the family during the spring and summer lived upon Monument Street, East Baltimore, and adjoining the premises was a privy or sink in such bad condition, that the odor arising from it was so very disagreeable as to make them close the windows to exclude it, even during the hottest weather of the summer. Here, in the homely language of the mother, the children began to get pale and puny, lost flesh and strength; and one child, a daughter of eight years, broke down with apparently an intermittent fever, for which a physician was called in. He prescribed and she rallied for a time, but again and again broke down, and finally losing flesh and strength, gradually in a few weeks, drifted into typho-malarial fever, and the family moved to another street thinking, very correctly, that their location was an unhealthy one. The movement, however, was made too late; since their removal to their new home the case progressed from bad to worse, and two additional cases of typho-malarial fever occurred in the family. The term typho-malarial is used here, because each one of the cases began as an intermittent fever, and in spite of the excellent and intelligent treatment of a physician in the neighborhood, slowly but surely gravitated downwards until a well-marked typhoid grade was clearly established. In each of these three cases the poisoning was chronic, that is, administered for some months, and its depressing effects clearly noticed before the final development of well-marked typho-malarial fevers.

have traced the course to its proper source, and we have in the number of cases in each family eradicated the possibility of accident as regards source of infection. The number involved the deaths which have marked its course, and the absolute certainty of sewer-gas contamination, recognized (the nuisance being corrected in two instances), give us the right to say that here at least we have been able to place the hand of "Sanitary Science" upon one cause of most dangerous undermining of public health; a cause of death which should have been met upon the very threshold of its existence, and by timely measures its direct and remote effects warded off. This is the province of sanitary science: to detect the endemic in its inception, to measure its power for evil and strangulate it in its birth. In the battle of life, the desperate struggle for existence, where so much work is to be done, why should the individual, the community, the city or State be clogged by the dead weight of those who consume and yield no return? The statistics of your modern battle-field, under the head of *Casualties*, give you accurate groupings of not only deaths, but wounds and injuries; but our ordinary vital statistics give only deaths; no mention is made of that much larger crowd, — that army of not killed, but badly wounded, — which as invalids and drones upon society, burden heavily the family, fill our dispensaries, our hospitals, and our alms-houses.

And this subtle sewer-gas, so universal in all cities, what is to be done with it? Often acute and violent in its manifestations, but more frequently by far a secret agent; a pestilence walking in darkness; a croupal terror by night and a fever of "destruction that wasteth at noonday." We do not say that this "gas" is the direct cause of diphtheria, membranous croup, or typho-malarial fevers, in the sense of being the one and only efficient cause; but we do contend and we defy criticism here, that in Baltimore city, it has most assuredly been the *one* constant factor invariably present, in the most malignant and well-defined *house endemics.* The death-rate has not been, it is true, large, but the list of wounded, no one has properly estimated, and the remote consequences — in the burden of invalids, increased vulnerability of children, and general deterioration of special families, residing in houses of bad hygienic arrangement, — can only be appreciated by the physician who carefully watches the ultimate results and as carefully analyzes the elements of causation.

In these croupal and diphtheritic families other maladies arise, and the practitioner faithfully and honestly performs his duty, but is astonished to find his best efforts but poorly rewarded; medicines fail to do the work he has so often seen, and he is indeed a clear-headed man, if he grasps the true solution of the position, and recognizes the hidden undercurrent of constant trouble and does not, as too many of our profession do, become skeptical as to the action of all medicinal agents. For in medical and in sanitary science nothing leads so rapidly to skepticism, as imperfect observation, imperfect classification of facts, and imperfect analyses of phenomena; from incorrect and insufficient data visions and unreliable conclusions flow as a natural stream in human thought. And few understand or appreciate the work of a Sanitary Commission or Public Health Association, unless a

terrible epidemic is sweeping a city and damaging its commercial prosperity. The endemic causes, if slow in action, though they may be the veriest "dry rot" of public health, are ignored, and by even good medical men avoided. He is indeed a brave advocate of true hygiene, who will dare tell, in Baltimore, a wealthy family, that the back yard is uncleanly, the water-closet improperly watched, the sinks too seldom emptied, and the slops too much exposed in the rear alley. This honest practitioner will lose that family, who will employ another who does not remind them of these evidences of defective hygiene, due to either carelessness, ignorance, or culpable negligence. We make this statement advisedly, for we have found that such interference is tolerated, only in cases of rented houses, where owners of property are responsible for the condition of sinks, privies, etc., and the occupants are thus able to shirk responsibility. We make it the more confidently, because in two of the *house endemics*, the nuisance could not be abated, until a direct appeal was made to the public health officer of the city. In one instance, as already stated, eight persons were at one time sick in one dwelling or rented house, and yet every appeal to the owner failed to procure the proper recognition of the cause of the trouble, and the legal authority for the regulation of the hygiene of the city, alone saved, in our opinion, the spreading of the infection. That the public must be educated up to the point of an intelligent comprehension of proper hygiene, is a self-evident proposition which we most earnestly advocate; but in what proper hygiene consists, has not as yet been so accurately defined and so very thoroughly simplified, that it can be grasped by every intellect; the very object and aim of the "Public Health Association" should be to so collect and classify data, that the deductions from statistics obtained may be made available in this public education. Even then, the strong arm of the law will be necessary to make the many perform the clearly expressed and well-known duties; therefore do we most strenuously advocate the passage of stringent laws as regards public hygiene, and also advocate a "State Board of Health" for each State, and an annual congress or meeting of these boards, that there may be unity of action, broad generalization, and an intelligent comprehension of the true condition of the country, of the causation of endemics, epidemics, and of the action of various morbific agents in the production of disease.

The legislature of each State, and the common council of each city should pass and properly enforce the requisite laws; but *they* cannot act intelligently, and at the same time economically, unless this "Public Health Association" provides the proper information so classified as to be readily and easily handled. The merchant in his counting-room, the lawyer in his office, the laborer at his daily toil, knows not and cares not about these things, unless brought sharply home to them by very severe family affliction; their spheres of action are removed from the observation of these phenomena, but each one will comprehend a simple and concisely expressed statement of deaths, their causes and possible prevention.

Now this is the work of this Association, and when placed in such form before the legislative bodies of our country, we may expect such laws as

will enable us to carry into effective execution the much-valued, though but little comprehended, "Sanitary Science." The "Congress of State Boards" could readily arrive at definite conclusions as regards "hygienic laws" for cities, and could furnish accurate data for action of city councils and state boards, and these could furnish the respective legislatures with all essential information. But the discussion of sewer-gas, emanations from cesspools, contaminated wells, etc., will be futile, unless proper legislation be obtained, and severe fines, or other punishment imposed. What if medical men know the sources of trouble and infection, and are yet unable to remove them?

In conclusion we observe that the history of the cases given shows us most conclusively the action of sewer-gas, and also the absolute necessity for proper legislation upon the hygiene of cities; it shows also how powerless the physician was to correct the cause until the law aided him. This "Public Health Association" can and should furnish the proper data for the information of the legislative bodies; and the laws passed should be as explicit and strictly enforced within the limits of any city, as are the laws of quarantine in its harbor.

A PLEA FOR SANITARY ENGINEERING.—A REPORT ON EFFICIENT HOUSE CONNECTIONS WITH SEWERS AND THE PROTECTION OF HOUSES AGAINST SEWER GASES.

By F. H. HAMBLETON, C. E., *Baltimore.*

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

Of the various branches of science dedicated to the promotion of the health and comfort of mankind, there is perhaps none that shares so slightly in public appreciation and gratitude, in proportion to its merits, as does the drainage department of sanitary engineering.

This discouraging attitude of the people, however, toward the laborers in this field, does not seem to be due to any disposition on their part to discriminate unjustly against them, nor to any special reluctance to accord to them their full measure of praise, but is rather the natural result of the very limited general acquaintance with the nature and difficulties of the engineer's work, owing to its invisible character, or the degree of success which has attended his efforts.

With a hope of modifying, to some extent, these unfavorable conditions, I propose briefly to set forth, in a popular form, the state of the art in certain respects, and how far engineers are responsible for what are commonly classified as failures by reckless writers or irresponsible rumors.

London, with its immense introduction of pumping machinery, and its miles of new conduits to distant outfalls, has only incurred an additional expense over that for the old sewers (which were probably a source of profit over surface drainage) of some seventy-five cents per head per annum of her population. Assuming that the foregoing sustains reasonably well the proposition that sewerage can be introduced into any city at reasonable expense, we may proceed to show what advances in the science of sanitary engineering have contributed to this state of things. The cost of sewers has been materially decreased by the introduction of small pipe sewers of dimensions commensurate with the duties they are to perform, instead of providing large and expensive channels of brick for large and small quantities of sewage alike; and secondly, the introduction of steam-pumping machinery has enabled the engineer to choose arbitrary grades for the lower portion of cities, which are too flat to produce natural flow to any useful extent. Grades can now be chosen which will insure the drainage of the houses getting into the sewers, and steam pumps will insure its getting out of them. The low parts of cities need no longer be allowed to fester in their filth, but they can send up their drainage into the main conduits, which conduct away the drainage from the higher parts by gravity, whereas, before the introduction of these improvements, the cost of construction was much

greater, and the satisfactory drainage of the lower parts of cities impracticable. Of course if the proportion of a city below grade is large, the cost of pumping will be large; but this item should not be charged against the sewerage system, because it confers upon the property participating in its advantages, in comparison with surface drainage and night-carts, new and valuable qualities, which neither the cart or the scavenger can substitute in any degree. It makes wholesome water-closets possible; it drains the subsoil, and consequently the cellars, and abates general dampness of premises and the presence of cesspools, and the demoralizing familiarity with filth consequent upon their use. It redeems low neighborhoods from inherent defects, it virtually raises them to an equality with nature's more favored sites, and it gives power to make the outfall of the sewers as remote as desirable from our habitation; therefore, instead of grudgingly contemplating the cost of such an improvement, it should be hailed with gratitude as a possible blessing within the reach of money, and an amount of money, too, small in comparison with the good results to be obtained therefrom.

Sewering a city would cost, of course, in proportion to the completeness of the system adopted; but it would seem that a city having favorable grades for drainage can get rid of much of its refuse cheaper by sewers than by carts and dredges, and that even those which have unfavorable grades could relieve themselves to advantage by pumping, and, if the improved condition of the property resulting therefrom be duly considered, there would be positive economy in it also. Where pumping is contemplated it should, of course, be confined to the smallest possible amount consistent with an efficient system of drainage by gravity for the higher parts of the city, but it would be bad economy to force the engineer to venture questionably near the low districts, or to stoop very low with the gravity system, because its whole efficiency might be impaired by trying to make it too comprehensive, and to curtail too much the territory pumped. It should be borne in mind that the greater the quantity pumped under like conditions the smaller the cost per gallon for pumps, fuel, and labor; and, whilst pumping a little more than might be actually necessary, would promote the excellence of the gravity system, and insure the efficiency of the pumping department, pumping not quite enough would compromise the excellence of both. The proposition to pump, when considered in the abstract, reasonably enough terrifies the timid tax-payer on account of its apparent cost; but the notion held by many, that sewage cannot be satisfactorily pumped, is a fallacy, as experience has shown that sewage yields as readily to the pressure of well-contrived pumps as it does to the simple solicitations of gravity.

Having touched upon the cost of sewers and their universal practicability, owing to the present state of the art, it may be asked what is to be gained by their introduction. Well, those who are disposed to be antagonistic to any departure from primitive ways (and they are not peculiar to any community), will reply, "Sewer gas and all its dreadful attributes, disease and death, and obstructions and foul smells," etc., etc. This cannot be denied to be the case to a certain extent under certain circumstances. Sewer gas is dangerous and does kill occasionally, but not more

certainly than does illuminating gas when allowed to escape in the house; sewers do accumulate deposits and generate bad smells, but not as much so as cesspools. Water-closets, an essential adjunct to sewers, do conduct sewer gas into houses when their connections are improperly made; so do privies. Sewerage has its imperfections, just as anything else of human contrivance has, but let us judge them by comparison with what they may substitute.

We should be relieved of cesspools, with all their foul and dangerous emanations and disgusting odors and conditions. Secondly, we should not be inconvenienced even by the odorless excavators in our streets (which, by the way, are a vast improvement upon the night-carts). Thirdly, we should not have vast accumulations of night-soil in our rural districts, freighting the air of their vicinity with foulness. Fourthly, we should have comparatively little of the putrid accumulations in our gutters, which now become stranded on their long voyage in their present cobble-stone channels. Fifthly, our back alleys would no longer be reeking with decomposing filth from the slops thrown into them. Lastly, from the time our refuse matter entered its initial sink until it emerged at its point of destination, it would travel in subterranean channels, leaving our streets comparatively clean and undefiled. As to the sewer gas, the danger from it may be provided against for all practical purposes by making the ventilators to the sewers in the streets sufficiently numerous to give the requisite distribution of the gas in its escape to insure a sufficient degree of dilution with atmospheric air to render it innocuous. As these ventilating shafts are arranged at present, they prevent the draft of gas up-grade in the sewers, and consequent concentrated discharge at their summits in dangerous quantities. The grades now are divided into steps, at frequent intervals, and a ventilating shaft is introduced at each step or artificial summit, so that the volume of gas that used to be given off at the high end of the sewer is now so divided and diffused as to be rendered harmless. The sudden and dangerous discharges of gas is owing mostly to the variable quantities of sewage flowing in the sewers; for if the sewers are running only half full, the balance of their capacity is at times occupied by gas, at which time, if there should be a sudden increase of the volume of sewage flowing from rain or a backing up of tide in tide or otherwise locked sewer, a corresponding amount of gas must be dislodged by escaping at the higher end of the sewer if not ventilated, and sometimes, where the sewer is long and the pressure is considerable, it escapes through the house connections into the houses by forcing the traps; but, by dividing the sewer into comparatively short lengths between the ventilators, these conditions cannot obtain. Another advantage from the multiplication of ventilation is, that in case the quantity of sewage flowing is suddenly diminished, as after a rain, the fresh air from the outside is drawn in with purifying effect; in other words, a kind of breathing goes on, an inhaling of pure air and an exhaling of foul air, — the process upon which we are dependent for the purification of the blood in our veins.

There is another mode, however, by which sewer gas is imported into our

houses under more dangerous conditions, because its presence may be constant instead of spasmodic, as in the former case. This mode is through the trap of the water-closet, their chief dependence, as usually arranged, to cut off connection with the sewer. If a small leak should occur in the pipe-trap, or a rag should lodge in the exit side of the trap and hang over into the down-pipe, the trap will be unsealed, in the latter case, by capillary attraction, and a free communication made with the closet, and in most cases with the house. If this state of things goes undiscovered sufficiently long, sickness is generally the result. If this should occur in winter, when our houses have a partial vacuum maintained in them by the draught of the stoves and ventilators, gas is drawn in under all conditions of the sewer with great rapidity and in great volumes. This condition is equally possible with the cesspool as with the sewer; the evil, however, is not without a reliable remedy, and therefore is not an inherent defect, but is the result of carelessness or false economy. To prevent sewer gas from getting into the house through water-closets or drains, the communication with the house should be entirely severed, and in the case of the closet it must be thoroughly isolated from any connection with any room which is an integral part of the house, or so connected therewith as to participate in the reduction of atmospheric tension, due to artificial heating and ventilation.

This can be accomplished by so arranging the door of the closet that it shall open into the free air only, the approach to its door being through a latticed gallery or porch, as short as you like, from the door of the house to the door of the closet. The result of this would be that the closets would always have the normal atmospheric pressure in them, whether the house had or not, and consequently there would be no drawing of gas into them through defective traps, and such gas as might find its way into them by pressure in the sewer or otherwise, would find its way out again through a ventilator extending above the roof of the dwelling.

These closets need not be cold in winter, because they could be as much in the house as now, and have three warm walls in consequence, the only difference being that their doors open to the air instead of into the house.

These conditions can be had in almost any house, being merely a matter of dollars and cents; but if people choose to risk the cheaper process, the fault is not in the use of the closet and sewer, but in the abuse of them. The other drains of the house should terminate in and be sealed by a catch-basin in the yard, having communication with the sewer and the open air, so that any back draught from the sewer would not be led into the house.

Having stated the objections to the water-closet and their remedies, we may dwell a little on its virtues. It will hardly be denied that there is no comparison between the comfort of a well-conditioned water-closet, with its solitary seat, and that of the old-fashioned privy over an open vault, with its multiplied accommodations, whither gossips repaired in couples, and by their prolonged privy counciling fretted the patience of their anxious successors for hours at a time. Who does not remember in some of these storied structures the chilling blasts that played through them in winter, promoting colds and rheumatisms; and how their remoteness and their inconvenient

approaches (often in the humbler dwelling through rain and snow) induced procrastination (especially during the night, or sickness), when nature prompted us to perform one of her most important functions, how pains admonished us that by procrastination we were violating one of her first laws? Who does not know that the nerves which impel us to act, become torpid by neglect or abuse, and that costive habit is the result of persistent procrastination? And are we not all familiar with the fact that costiveness produces headache, general debility, loss of appetite? And do the medical men not tell us that it may result in hemorrhoids, impaired nutrition, engorged kidneys, hypochondriacal condition, from perverted and retained secretions and excretions, — diseases which are not generally destructive to life, in the ordinary acceptation of the term, simple existence, judging from the death statistics, but they are destructive to that life which means health, comfort, energy, strength, capacity for labor and enjoyment, or the ability to endure the rougher tasks of life.

I maintain that although the death rate in most places where sewers and water-closets have been introduced, shows great improvement, that these statistics alone only indicate a part of the benefits that have accrued to the community from their use. Assuming that it has been made plain that there is a practicable mode of getting our sewage into sewers without a formidable degree of danger, we may next inquire, how are we to get rid of it at the outfall? Well, if there is an ample area of water at this point, and its defilement is of no especial consideration, why let it flow into it, as the cheapest mode; if there is suitable ground at hand use it for irrigation; if it cannot be used for irrigation, and the water into which it is discharged must be kept as pure as possible, why clarify by some of the many processes which the state of the art provides, so that the effluent water is at least nearly inoffensive; the residuum to be burned into cement, or possibly used as manure, as is so persistently urged by those who do not know the difficulty of sustaining such an operation. Victor Hugo, for instance, exclaims in his masterly style: "Those heaps of ordure in the corners of the streets, those cart-loads of manure which go jolting along the streets at night — those horrible tubs of liquid — the pestilential flood concealed beneath the pavement, do you know what it all is? — it is the meadow in flower — the green herb — the wild thyme and clover — it is the abundance of game — it is the flocks of sheep and herds of cattle — it is the contented lowing of oxen in the evening — it is the scented hay and golden corn — it is the bread upon our table — it is the rich blood in our veins — it is health — it is enjoyment — it is life, so it is ordained by that mysterious creation, which is transformation on earth and transfiguration in heaven. Give all these to the great crucible, and receive back abundance. The nutrition of plants is the food of man." Now this poetical protest against allowing sewage to run to waste, whilst it serves to embellish the literature of a nasty theme, falls short as an equitable view of the case. It might be said, on the other hand: These ever-increasing and interminable railroad connections, these extended canals — this growing commerce, do you know what it all is? it is the concentrating of the products of the fertile fields of unlimited territory

within the limited confines of our cities — it is the cheapening of fuel in our midst, and the consequent increase of manufacturing establishments, with their immense contributions to our refuse matter — it is the ability to manufacture concentrated fertilizers with which sewage manure cannot compete at the price of produce from remote, and naturally fertile, agricultural regions — it is the disproportionate increase of water supply to meet these new demands upon it — it is the overburdening of sewers proportioned to the normal condition of things — it is the degrading of the valuable properties of our sewage with "profligate associates" to an extent that makes their redemption unprofitable ; and, finally, it is the arraigning of the sanitary engineer for not having shown prophetic anticipation of all these unknown quantities in his provisions for drainage. Give all these things to the crucible of criticism, and receive back the grateful acknowledgment of a righted profession.

IV.

HOSPITALS.—SANITARY CARE OF CONTAGIOUS AND INFECTIOUS DISEASES.

THE SANITARY RELATIONS OF HOSPITALS.

By WILLIAM PEPPER, A. M., M. D.,
Professor of Clinical Medicine in the University of Pennsylvania.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 10, 1874.

The object of the writer is to offer a few practical suggestions on the subject of hospital construction as bearing on the result of treatment. This question, although somewhat restricted, cannot be denied a large share of importance. The rapid increase in the size of cities both in this country and abroad, is rendering necessary a rapid increase in the number and size of hospitals. Public attention, also, is being forcibly attracted to a consideration of the proper construction and management of these institutions in consequence of the real importance of the subject, and of the rapid growth of a spirit of intelligence and philanthropic interest in all great sanitary questions.

This interest has been evidenced, and, at the same time, greatly stimulated by the numerous publications which have been made of late years bearing on the question of the sanitary relations of hospitals, and especially has this been so since the appearance of the well-known article on "Hospitalism," by the late Sir James Y. Simpson, of Edinburgh, in which he endeavored to show that large hospitals are banes rather than blessings, and that the plans of construction hitherto followed are erroneous and lead to disastrous results. The numerous severe wars which have occurred during the last decade have also furnished interesting and valuable evidence as to the results of the treatment of surgical and medical cases in tents or barrack hospitals, and thus have added great importance to the study of the sanitary value and efficiency of the large civic hospitals in various countries.

The results of this investigation have been, it must be acknowledged, of a startling and momentous character. It has been shown that some few of the largest and most popular hospitals in this country and abroad are actually productive of so large a rate of mortality among their inmates, and

especially among those suffering from severe wounds or who have undergone serious surgical operations, as to make it doubtful whether their existence is not an injury and a curse to the community in which they are situated.

It has been further shown that in others, where no such deplorable condition of things exists, the death-rate is still alarmingly high. In examining into the causes of this excessive mortality further, it has been shown that a considerable part of it is due to the frequent occurrence in such hospitals of cases of disease of a peculiarly fatal class — such as pyæmia (or surgical fever), hospital gangrene, erysipelas, and the like, — affecting surgical patients especially, and which are known to be due in many instances to the diffusion of septic poisonous emanations.

Simpson collected an extensive set of statistics of mortality of certain wounds and operations in private practice and in small rural hospitals, from which he drew the conclusions above stated; and the results derived from tent and barrack-hospital practice during recent wars, confirm the statement that in large city hospitals the rate of mortality, after wounds and surgical operations in particular, and of all diseases in general, is frequently higher than in similar cases treated in private practice, or in small isolated hospitals. Up to this point the facts are conclusive. But the more important and difficult question of their signification remains to be solved. Simpson attempted this in his usual trenchant manner. Assuming that this excessive mortality was directly and essentially connected with the hospital itself, he employed the term "Hospitalism," to imply a peculiar fatal septic influence generated in large hospitals, and the more intensely the larger the hospital, which proved the cause of death in many cases which would have recovered under other circumstances. The conclusion followed readily that it was our duty to demolish these pest-houses, and to erect "wooden, or brick, or iron villages" as a substitute.

His data and conclusions were vigorously assailed by various authors, — notably by Mr. Holmes and Mr. Callender; and the more recent writers who have adopted his views have usually expressed them in a modified and more cautious manner. Still it cannot be doubted that the drift of popular opinion, both in and out of the profession, has been setting against the erection or continued use of large hospitals, and in favor of substituting comparatively small isolated buildings, on the general plan of the barrack first used with so much success in our recent war. I have of late had such frequent occasion to meet with this opinion while superintending the erection of the new University Hospital in this city, — which is to be a large building, consisting of a main central structure with lateral three-story pavilions connected by a main corridor, — as to lead me to examine seriously the question of the justifiability of erecting such a structure for hospital purposes. And I beg now to offer a few informal and undeveloped thoughts on the subject, — in support of the view which I strongly embrace, — that there has as yet been no good reason advanced for an abandonment of this or some analogous mode of hospital construction.

In the first place, I confess myself unable to appreciate very highly any of the statistics which have been advanced on this question, for the following reasons: —

a. That the class of cases, the severity of the lesions, the constitutional condition and morale of the patients, are not shown to be analogous in the two sets of figures. This holds good both in rural and military as compared with civic practice.

b. That in the most convincing set of statistics, — those drawn from private practice, — it is certain that the returns do not represent fairly the average result in any given district.

c. That the statistics bear only on certain classes of cases (wounds and operations), out of the many for which hospital accommodation must be provided (fractures, medical cases, etc.).

d. That at most the statistics prove nothing against such hospitals, *per se*, but only against certain remediable abuses and errors in their construction and administration. Thus, for instance, it is evident that if certain well-known conditions, requisite for health, and especially for the successful treatment of serious diseases, be neglected or willfully departed from, increased mortality will inevitably result, whether the cases be treated in a large hospital or in small isolated barracks.

I fail to see why these last conditions, — perfect cleanliness, thorough ventilation and insolation, ample allowance of air or ward space to each patient (*i. e.* entire absence of overcrowding) ; careful grouping of cases, so as to avoid accumulation of cases of certain classes in the same ward ; uniform and suitable temperature ; skillful, assiduous nursing and treatment,— cannot be as well obtained in large hospitals as in isolated small structures.

It is of course evident (as pointed out by Ashhurst and Holmes) that, if the hospital authorities allow their buildings to become so overcrowded that the patients are deprived of the needed amount of pure fresh air, while at the same time the milder cases are turned into "out-patients," and the wards contain a disproportionate accumulation of grave cases of suppurating wounds, extensive burns, compound fractures, serious operations, or, in the medical wards, of erysipelas and infectious fevers, an increase in the death-rate will occur. Not only will more per centum die than in another hospital where the wards are filled with cases of mixed character, mild with severe, but more will die per centum of any one of these classes of grave cases than would die if treated in a hospital where there was no such unnecessary and criminal "overcrowding." Or if, again, actuated by an utterly false conception of their duties to the community, the authorities of any hospital are induced to erect additional wards on their grounds, so as to interfere with the supply of light and fresh air to the original structure, or to convert rooms inadequately supplied with the necessary conditions into wards, it must inevitably follow that the sanitary condition of the hospital will suffer, and that a corresponding elevation of the death-rate will present itself.

Many of my hearers may be familiar with a now notorious case, — that of the Norfolk and Norwich General Hospital (England), — which has recently been made the subject of an able invective by Dr. Beverley, one of the surgeons connected with it. According to his statistics, — and they are unquestioned, — this hospital, up to the year 1862, stood almost alone in

the success that attended its surgical practice; 910 persons had been operated on for stone, and 792 had recovered. On two occasions 40 cases of stone had been operated on without the occurrence of a single death. Yet during many years the hospital had been receiving a large but not an excessive and disproportionate number of cases of wounds and burns, and cases requiring surgical operation. Still, until 1862, the existence of "hospitalism," that fatal septic influence, was not suspected. Since that time an excessive number of the above cases has been admitted, great overcrowding has resulted, and the governors have even modified the original plan by building more wards so as to interfere with ventilation.

The pressure upon the accommodation of the hospital may be judged of from these figures: —

	1854 to 1863.	1864 to 1873.
Surgical Operations	1666	2513
Wounds	359	779
Fractures, Burns, and Scalds	271	491

It is perhaps needless to say that a frightful increase in mortality has occurred in this once model hospital. Yet I can conceive of nothing more fallacious than any argument against large general hospitals based upon such cases as these. The conclusion — the only warrantable conclusion — that can be drawn is, that so long as the business of the hospital was kept within its legitimate limits, hospitalism was unknown; but with the advent of unjustifiable overcrowding came also this dreaded and fatal result.

I cannot lay too much stress upon this question of overcrowding and imperfect ventilation, because I truly believe that the prevalence of these defects in most large hospitals of any considerable age, popularity, and wealth, has been chiefly responsible for the unfavorable results charged against so many of them. It is to be observed, also, that this evil of overcrowding is most apt to be constant and extreme in those very institutions where it can least be tolerated, and which are, for obvious reasons, most apt to be selected for statistical investigation. I refer to the large municipal hospitals in the principal cities both on the continent of Europe and in America. As these depend for support upon appropriations made by the municipal government, and are compelled to receive all applicants, there is usually no power in the hands of the hospital authorities to prevent the most flagrant and fatal overcrowding. When it is borne in mind further that the patients gathered in such institutions are from the most abject and enfeebled classes of the community; that in many instances the buildings themselves are wanting in the requirements for a successful hospital, and that it is frequently impossible to obtain from the city authorities a sufficient annual sum to properly conduct the ordinary affairs of the institution, much less to supply it with the artificial forced ventilation which is needed in such buildings, it will be no source of wonder that the rate of

mortality in the municipal hospitals of Paris, Vienna, Berlin, New York, and Philadelphia, should be disgracefully high.

On the other hand, in hospitals which depend upon private subscriptions for support, the income is scarcely ever large enough to enable the hospital authorities to admit a very excessive number of patients, and thus one very powerful check upon overcrowding exists. If, further, as is the case in very many of the hospitals in this country and England managed by private corporations, a constant, energetic, and intelligent care is exerted in the avoidance of all defects or abuses of administration, and in the improvement of the means of ventilation and heating, it may be confidently asserted that a rate of mortality will be secured so low as to compare favorably with the results obtained in the treatment of strictly analogous cases in isolated barrack wards.[1]

In using the term "avoiding overcrowding," I do not express all that I conceive to be the duty of hospital authorities in this direction. It seems to me indispensable, no matter on what plan a hospital is constructed, that certain wards should be rigidly and invariably kept in reserve, only to be occupied when from time to time the various wards in use are vacated in regular rotation for purposes of complete cleansing, or, if necessary, of renovation. The frequency and extent of such renovation must depend upon the character of cases treated in the ward, and particularly upon the occurrence of the slightest evidence of septic infection. It is to be remarked here, that such renovation of the wards of a large hospital can be more readily and far more economically effected than can the destruction and restoration of a temporary barrack. In the ordinary course of events, even when not the slightest evidence of infection has been developed, each ward should be successively vacated, say once in three or four years for three or four months, the beds scraped and repainted, all utensils renewed, the floors planed and treated anew in the original manner adopted, the ceilings and walls thoroughly cleansed and coated afresh with some non-absorbent application, the remaining wood-work scraped and repainted. If any serious cases of infection have occurred, it would be easy to hack the walls and ceilings and to replaster them, and to entirely renew the flooring.

I have had ample opportunity of observing the entire success of even less thorough renovation of old wards which had become alarmingly infected. Perhaps in few, if any, hospitals in the world is a larger proportion of cases of wounds, compound fractures, and cases requiring surgical operation, treated than in the Pennsylvania Hospital in this city. On more than one occasion, during my acquaintance with the administration of that noble charity, has one or another of its surgical wards become infected with pyæmia, or erysipelas, or gangrene, to such an extent as to induce a removal of the patients to a distant ward, a complete closure for several

[1] Since reading the above paper, a letter has been published in the *Philadelphia Medical Times*, November 21, 1874, by one of the surgeons of the Pennsylvania Hospital (to which reference is made further on), which confirms in the strongest possible manner the views here presented. It may be mentioned that the present building of the Pennsylvania Hospital has been in constant and most active use for 120 years.

months, and a thorough cleansing of the infected ward. In every case, after the reopening of the ward, the results of treatment have been as favorable as in an entirely new structure. In no instance, save only in the occasional occurrence of a few cases of facial erysipelas, have I known the medical wards of that institution to present any conditions which would justify the belief that the patients there treated were subjected to any depressing septic influence.

In the case of Bellevue Hospital, New York, and of the Philadelphia Hospital in this city, the very unfavorable results obtained at certain times are, as I have already suggested, plainly attributable to gross defects of construction, and to a degree of overcrowding only to be pardoned on the score of the culpable penury of the city authorities in regard to this vital question of public health.

In the remarks I have made I have assumed that the large hospital was constructed so as to present the necessary conditions for successful treatment of the sick. I am sure that many of the great hospitals now in existence deserve richly to be razed with the ground for their utter failure to comply with these simple requirements. But I cannot draw from this the conclusion that it may not be desirable to erect new hospitals as they are required, of large, even of palatial dimensions, but in more strict conformity with sanitary conditions. These are simply: —

Free exposure to light and sun.

Free supply of pure air, — both by natural and artificial ventilation, — and thorough removal of the exhausted or foul air.

Means for securing a uniform degree of pleasant heat; and to favor absolute cleanliness, as by the entire absence in the wards of cracks, recessed angles, etc., where dirt may collect.

The employment of the most non-absorbent surfaces, and their coating with non-absorbent applications.

Entire separation of wards.

Entire separation of all water-closets, slop-hoppers, etc., from the wards, and independent arrangements for thorough ventilation of the former.

Existence of spare wards, to be used from time to time.

It is desirable, also, that there should be in connection with every large general hospital, a couple or more of isolated wards, — each, if possible, containing also several separate small chambers, — for certain classes of cases which are not suitable for admission into a general ward. Such would seem to be, among surgical cases, extensive burns, wounds, or operations causing exposure of very extensive suppurating surfaces; cases of traumatic erysipelas, or of gangrene; and among medical cases, infectious fevers, erysipelas, dysentery, etc.

I am convinced that all of these are readily obtainable in a well constructed hospital at the present day; and I am assured, from the ability and energy with which questions of ventilation, heating, and construction in general are now being investigated, that still better results will soon be achieved.

I have thus imperfectly attempted to express some of the reasons which make me feel that the charges hitherto brought against large hospitals do

not prove any essential defect, but merely that errors in construction or administration have frequently been committed.

A second important argument in favor of large hospitals seems to me to be found in the economy of their *construction* and *administration*.

In the discussion of the relative merits of different styles of hospitals, the importance of these considerations appears to be frequently overlooked. It is easy to say that it is not necessary for a city to provide hospitals for its sick poor; but that if it does, it is its plain duty to supply the very best kind, irrespective of expense. I think it will rather be held that it *is* the imperative duty of cities to supply ample hospital accommodation within its limits; and also that, looking to the enormous drain which the provision and maintenance of hospitals makes upon private and public funds, it is obligatory that this should be done in the most economical manner consistent with efficiency.

a. The first element of expense in connection with the hospital is the *ground*. It is necessary that this should be well situated as regards elevation and surroundings; it is necessary, also, that it should be of ample size, so as to ensure abundant supply of air and light. But it is also necessary that it should be in a central location, so that patients may the more readily be transported to its wards, but chiefly in order that it may secure the constant, assiduous services of the experienced and skillful physicians and surgeons in the community. It is needless to say that if the site were chosen so far from the centre of population of the city as to be where land is cheap, it would probably be so far distant from the residences of the leading medical men that the hospital would be compelled to depend upon salaried medical officers permanently attached to it. It will be conceded by all that no more unfortunate result could happen. Yet it may safely be asserted that to erect hospitals on the plan of isolated tents, or one-story barracks, will require much more than twice as much ground as is needed for a hospital of equal capacity built on the improved pavilion plan. It is sufficient to contemplate the difficulty of replacing the present hospital accommodation of London by a large series of "brick, wooden, or iron villages," as urged by Simpson.

b. It is frequently asserted that the original cost of construction is greatly less in the case of barrack hospitals. This, of course, is true of light wooden structures, or of canvas tents. But it seems to me that it has not yet been demonstrated that such accommodations are suitable for a permanent hospital organization in our climate, and for the class of patients who seek shelter in our large city hospitals. When it comes to a more substantial barrack built solidly of brick, and furnished independently with all the needed conveniences, I doubt if such accommodation can be provided, ready for use, at a cost of much less than $400 or $500 per patient, which approaches the cost per patient of large, handsome, permanent pavilion hospitals, constructed in the highest possible style of architectural thoroughness.

Add to this that the great, the characteristic advantage claimed for barracks and tents is that it can be afforded to tear them down and replace them by new structures at certain intervals. For it must not be overlooked

that even the warmest advocates of barracks acknowledge that there is danger of septic infection if their wards are long occupied by a serious class of surgical cases. It is difficult to conceive how it would be possible to successfully conduct the large hospitals of such a city as this on a plan which required the erection of buildings at a cost of $400 or $500 per bed, which were destined to destruction at the expiration of five years, or sooner if evidences of septic poisoning made their appearance. I have already pointed out that if anything less thorough than entire demolition and reconstruction is intended, it is quite as easy to renovate the wards in a large hospital as in an isolated barrack. And let me remark that in advising the construction of two or more outstanding barracks in connection with every large general hospital for the reception of certain classes of cases, I had reference to very inexpensive wooden structures, of strictly temporary character, and designed to be invariably demolished after a few years' use; though, as already remarked, I think it yet remains to be shown that such structures are as well adapted for continuous occupation in all seasons by the enfeebled class of patients who fill city hospitals, as the wards of a well-constructed hospital of large size.

c. It is only necessary to allude to the very great increase in the difficulty and cost of administration of a hospital of large capacity constructed on the plan of detached barracks. It would include a far larger outlay for heating apparatus and fuel, greater expense in the kitchen department, in attendance, etc. But this is too self-evident to require further attention.

Thirdly, in addition to the advantages of economy possessed by large pavilion hospitals, must be mentioned the great importance of facilities for clinical instruction in connection with hospitals in large cities. The division of a hospital into a series of widely detached small buildings must inevitably prevent anything like systematic clinical instruction before large classes. It would be manifestly impossible to transport very many of the most instructive cases of disease or injury to any central building where accommodations were provided for lectures. And yet, so far as the health and vital interests of the community are concerned, there is but one feature of hospitals, namely, the sanitary interests of their inmates, which is of more profound importance than the full clinical instruction which should always be conducted in connection with them.

It is impossible to overestimate the practical importance of the question we have been considering. It can scarcely be supposed, if the unbounded abuse which has of late years been heaped upon large hospitals of permanent construction, should be continued, that the private generosity upon which so many of them, in America and England, depend for their entire support, will not be checked. It cannot be doubted that for certain classes of cases, isolated barrack or tent hospitals of temporary character are the best possible form. It is very certain that, in times of war, when a sudden and temporary increase in the demand for hospital accommodation arises, such structures have been highly efficient, and that reliance should be placed exclusively upon them, instead of allowing the permanent civic hospitals to be overcrowded by the reception of unusual

numbers of serious cases. It is also evident that for military and marine stations, where the hospital site can be selected without reference to the surrounding population, where the cost of administration is defrayed by governmental appropriations, where the extent of accommodation required may vary rapidly and even the permanence of the institution is indefinite, where the medical staff is immediately attached to the hospital, and no demand exists for clinical facilities, that barrack hospitals present many points of advantage. On the other hand, I have endeavored to suggest some of the practical considerations which make it probable that most of the necessary hospital work of great cities can be done, and well done, in large, substantial buildings, located in central positions.

As to the question of the actual relative merits of large hospitals and of isolated barracks, there probably exists considerable diversity of opinion. I can merely say that I am not aware of any statistics in existence which afford us the means of positively determining the question. It appears to me that there is needed for that purpose a large series of observations upon the mortality in a *well-constructed* and *well-administered* general hospital in one of our large cities, and in isolated barrack or tent wards in the same location, receiving the same run of cases, which should be subjected to the same method of treatment. It will not, I trust, be long before such sets of statistics are before the world. In the mean time, the general considerations I have attempted to express, as well as others, which time will not permit me to touch upon, compel me still to believe that it is possible to construct a large hospital with such due provision for ventilation, and to administer it with such constant, unswerving regard, not to the grand total of cases treated and operations performed, but to the sanitary conditions of the inmates, as that it shall prove a safe shelter for the sick and suffering, a successful field for medical and surgical practice, and one of the noblest gifts of an enlightened, intelligent, Christian community to the poor who are intrusted to their care.

I will not close without one word of appeal to all who hear me in behalf of this important subject. The papers and discussions which have been prepared by some of my colleagues, who have devoted much study to the construction of hospitals, are of themselves sufficient to show how much attention is being devoted to this question, and how much advance is being made in our knowledge of the materials and mode of construction, and of the methods of heating, ventilating, and disinfection; and to assure us that eventually the best modes of securing all the sanitary requisites in a hospital will be clearly determined.

But there is a matter of at least equal importance, on which, as a medical man connected with several hospitals, I may speak without hesitation. I allude to the vast importance of the proper administration of hospitals. The single instance I have quoted to you of the Norwich Hospital is sufficient to demonstrate the terrible results which may follow an injudicious or careless mode of conducting such an institution. It is too much the custom in all great hospitals, here and elsewhere, to trust the control of the sanitary interests of the hospital solely to the medical staff, while in many

instances the governors or managers are little more than the trustees and executors of a trust fund invested for the support of the institution. It must be acknowledged, however, that for manifest reasons, the medical staff are not the best persons to keep watch over the sanitary condition of the hospital. Conscious of their own pure zeal in relieving suffering and disease, willing to lavish their time and best efforts in the service of the poor without remuneration, they are too frequently tempted to urge or sanction the admission of deserving cases into the hospital wards beyond their strict lawful capacity. Intensely interested as they are in the treatment of the dangerous cases which constantly fill the wards, there is a risk that their attention is too closely riveted upon the actual duties of the day, to allow them to take at the same time a comprehensive view of the general results of the administration of the hospital as a whole, and of the sanitary condition of the building. To secure constant and critical attention to these all important matters, there is needed a superintendent possessing a high degree of ability, executive power, and acquaintance with hygienic laws; as well as more study and watchfulness on the part of the managing board of these institutions, which should invariably contain a full proportion of medical men not connected in any way with the medical service of the hospital. It is impossible that, with a clear business-like inspection of the results of the operations of the hospital, and of its general sanitary condition, such as would be given by a board composed partly of experienced men of business, partly of medical men, any grave departure from the correct principles of administration, or from average success in the results, should remain unnoticed and fail to receive whatever attention might be needed to rectify it. So that I would close by repeating my firm conviction that, with correct modes of construction and organization, and with a proper system of administration rigidly enforced, large permanent hospitals will be found to yield good average results in the treatment of medical and surgical cases, and that very many of the grave charges which have been brought against them will prove to have been evoked by the *abuse*, not by the proper use of these institutions.

NOTES ON HOSPITAL CONSTRUCTION.[1]

By JOHN S. BILLINGS, M. D.,
Assistant Surgeon United States Army.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 10, 1874.

Hospitals are endowed, built, and supported from various motives and for various ends. The primary object is of course the care of the sick, but the secondary purposes vary much. The building may be wanted as a monument and memorial of a wealthy donor, or of the public spirit, liberality, and taste of a municipal corporation, as an aid to, or an excuse for, the existence of a medical school or a benevolent society, or as an advertisement for an architect or a physician, — in short, political, theological, commercial, professional, and specially personal motives must be considered in addition to those of charity and public hygiene.

I say *must be* consulted, because if this were not done very few hospitals would be in existence, and when it comes to the practical question of preparing plans for a given hospital there will almost always be something in the site, limit of cost, or purpose, real or apparent, which will compel one to modify his theoretical and over *a priori* views. Experience has taught us, that carefully built and costly pavilion hospitals are not necessarily free from hospitalism, and practical trial of cheap wooden structures, or barracks, as military hospitals, has led to the recommendation that these should also be used in civil life, each ward building being intended to last about ten years. No doubt the results would be better in such buildings than those obtained in the majority of metropolitan hospitals, but it should be remembered that the low mortality in our large army hospitals was not due to their temporary character, for the morbific element due to length of occupation did not have time to develop in them. They were better located, better managed, and had a better class of patients, than those in civil life. When the hospital diseases appeared (and they did appear), tents were used, and the more they were used the better the result. As a question of economy, it is evident that if one half the money required for a costly brick or stone structure were used to put up plain cheap wooden buildings, and the other half were well invested, at the end of about twelve years the building fund would be what it was at first, the old buildings could be replaced by new ones, and the process repeated indefinitely. It will not often happen, how-

[1] It should be remembered that this paper was read in November, 1874. Since that time so many of the suggestions which it contained have been published elsewhere, that permission was asked to withdraw it from the Transactions. In deference to the wish of the Publishing Committee it appears as part of the history of the discussions on the subject, but with many elisions.

ever that the building fund of an hospital can be managed in this manner, and to obtain the full benefit of a barrack hospital the buildings must not be crowded, and no ward can have another room over it. Our large metropolitan hospitals usually are, and should be, connected with medical schools, and it is usually considered necessary to place them in or near the city, where space is limited and costly. I doubt very much whether this supposed necessity exists, and think it quite possible that the hospital may be placed ten miles away, where there is plenty of room, especially if there be means of water transportation. But if it be decided that the hospital must be in the city, it is possible to build it of brick in such a way that it shall have most of the advantages of a temporary wooden structure, except as to cost, and that it shall be much better suited to a limited space. One of the first questions in such a case is how best to arrange the kitchens and laundries to keep them from being offensive. This can be done by placing them in the upper story of a building in which there are no wards. This is the plan pursued in the new army hospitals at West Point and at the Soldiers' Home, near Washington. By the use of lifts this gives no inconvenience, space is gained, and the kitchen fire is available the year round as an aid to ventilation.

It is very doubtful whether an attempt should be made to render the walls of a ward impermeable. The statistics from such wards, when compared with those having ordinary plastered walls, or even with the results from earth or adobe huts, are not such as to recommend the process. If such walls are to be used, I should be disposed to advise that they be cleaned with fire instead of water, if a brush of smokeless flame can be constructed and applied. I should prefer, however, that the hospital should be of such capacity that one ward may always be empty with its windows wide open, and that the plastering with the ordinary hard finish, after semi-annual scrapings and whitewashings for about ten or twelve years, should be torn out and replaced. If the plaster is put up with this in view, for instance, on coarse wire netting painted, or in other ways which will readily suggest themselves, the greater part of the advantage of a temporary structure can be secured in a permanent one, although at an increased cost. The hospital at West Point is arranged in this manner. A device, sometimes used in army post hospitals instead of plaster, is to line and ceil the ward with canvas upon which coats of whitewash are placed, and the results have been good.

I believe that the causes of disease in hospitals are more often in the bedding, furniture, and utensils, and in the attendants, than in the walls or floors. One stuffed chair or baize screen, or soiled woollen blouse is more dangerous as a means of causing disease, than many square feet of plastered wall.

With regard to hospital ventilation. In tents and buildings of one story only, it is easy to obtain what is ordinarily considered sufficient ventilation, except in warm still weather, and this is the great merit of this plan of construction. In more complicated buildings where wards and rooms are superimposed, a positive force such as that of an aspirating chimney, or of a fan, or both, is necessary. In some of the twelve bed wards of our army

post hospitals, we have used a double fire-place in the centre of the ward, arranged to bring in fresh air between the fire-places and warm it previously to its admission to the room. If carefully made and adjusted, such a fire-place has been found by experiment to satisfactorily heat a room forty-eight by twenty-five by twelve feet, and to ventilate it at the rate of about 40,000 cubic feet of air per hour, the external temperature being at the freezing point. But when the temperature of the outer air is at zero, such a fire-place does not heat the incoming air sufficiently, and the inevitable result is that its entrance will be stopped by the patients or attendants.

There are one or two points with regard to this subject of ventilation which it may be well to remember:

1. Ventilation is not necessary to get rid of carbonic acid, for this gas is harmless in the quantity in which it is found in a hospital. The hurtful matters to be got rid of are such gases as carbonic oxide, sulphurous and hydro-sulphuric acids, and the organic particles both dead and living, thrown off from the skin and mucous membranes, and the importance of carbonic acid, is, that under ordinary circumstances the amount of it present may be taken as a measure of the amount of other more deleterious gases and organic impurities, while it is easier of detection and measurement.

2. Perfect ventilation of a room implies that a man does not inspire any air which has already been in his own lungs, or in those of any one else in the room. This can be effected for one person by such a contrivance as the air-chamber of Professor Pettenkofer, and for a large room by the arrangement made by Dr. Reid for the House of Commons, and better by Mr. Thomas Winans, of Baltimore, in his private residence, in which the floor is made one large sieve, and the rising air is taken out at the ceiling with comparative rapidity.

Such ventilation for wards would be very expensive, for it must be remembered that the fuel consumed to furnish ventilating power is not available for warmth. A pound of coal thoroughly oxidized furnishes a fixed amount of heat which is available for power or for heating, not for both. As has been said, there are but 100 degrees of percentage. Moreover, when fresh air is introduced through openings flush with the floors, dust is constantly being returned into the room. The ordinary plans of ventilation are arranged on the theory of largely diluting the foul air by large cubic space, and by large influx of fresh air thoroughly distributed. For gaseous impurities this is satisfactory, but for organic living particles of contagium, it will be seen that it affords little security. As regards the ventilation of water-closets it should go downwards through the seat above the trap, unless the Jennings' closet be used. There should be another means of ventilation above, and in many cases this can be most conveniently effected by the gas jet.

Thorough ventilation of the bath-rooms is as important as of the water-closets, and more so where vapor baths are used, in which case special precautions for cleansing and disinfection are necessary. As a rule sufficient care is not taken to secure perfect cleanliness in the bath and its appurtenances. A convenient mode of arranging the baths, water-closets, and slop-

sinks, is to place them around a central aspirating flue of large size, working by a small furnace stove in the basement, and entirely unconnected with the heating and ventilating arrangements of the wards. If this be done, and care be taken that traps cannot be unsealed and sewer gas forced out when a tub of warm water is emptied, — which is too often the case in private houses, — there will be little danger of trouble or annoyance in this part of the hospital. One water-closet at least in each ward should have a bidet attachment.

The subject of hospital construction has been much discussed for the last century, and its bibliography alone would make a good-sized pamphlet. It is true that the literature is mainly theoretical, but building a hospital is like curing a cold, — everybody knows more or less about it. It has been considered from the point of view of the hygienist, the physician, the architect, the tax-payer, the superintendents, and the nurse, but of the several hundred books, pamphlets, and articles on the subject with which I am acquainted, I do not remember to have seen one from the point of view of the patient.

The great defect which patients complain of in our metropolitan hospitals, is the lack of privacy, and the fact that their individual needs can only be met by one average set of conditions. They are placed in a large, bright room, with perhaps twenty others; on one side may be a man dying, or on the other a blackguard conversing with a visitor of like stamp. Every movement is under observation, and to many persons this is very unpleasant.

To a patient in the acute stage of almost any disease bright light is disagreeable, and none of us I presume would allow it for more than a short time in our own sick room until we were somewhat convalescent. While light is a powerful hygienic agent, having a special tonic and stimulant effect which can be obtained in no other way, I believe that in many cases of acute disease it does harm very much in the proportion in which it inflicts discomfort. We are all familiar with the fact that different patients, and the same patient in different stages, require different temperatures and degrees of moisture in the air. It is not possible that an acute sthenic febrile case should be benefited by the temperature required by the feeble, convalescent, or consumptive.

The majority of patients on entering would prefer a single room; they do not wish to be annoyed by visitors, their great desire being to be quiet and to be let alone. These small rooms increase the labor of nursing and of supervision very much, and are more difficult to connect with the usual systems of ventilation. But if the perfect system of ventilation to which I have just referred be carried out in them, much less space and air supply need be allowed. Thus, the experimental chamber of Pettenkofer contained but four hundred and twenty-four cubic feet, and when it is remembered that if the air were removed as fast as contaminated, without being allowed to mix with the surrounding air, a single man would not require over three hundred cubic feet of air per hour, it seems not impossible that the objection to small rooms on account of difficulty in ventilation may be in great part or wholly obviated with diminution instead of increase of cost.

The organic excreta of each individual seem, even in health, to be less

offensive and hurtful to himself than to others, and this is much more the case in sickness, hence the space required for each person increases in proportion to the number of persons, if these are to be placed together. It is probable that in the model hospital of the future the number of rooms for one, two, and three patients will be much increased, and that the twenty and thirty bed wards will be used only with convalescents and chronic cases, or in hospitals designed for but one class of patients. Much may be done in the large wards to obtain isolation, especially where the mode of heating is by indirect radiation, in which case two or three of the fresh-air flues should be made to open in the wall near the head of the bed, not more than a foot from the floor. Under these beds make an opening one foot square in the floor, communicating freely with the outer air, to be closed with a tight fitting trap-door when not in use.

When this cold air opening is to be used, it is to be covered with a lattice work or perforated box, about five by two and a half feet and one foot deep to break up the incoming current. Having this arrangement, by the use of wooden screens, almost any local degree of temperature and light desired can be secured. The obtaining a local low temperature for fever cases in the manner above described, has been successfully tried by Dr. Hoff, U. S. Army, in the Post Hospital at Sitka, Alaska, and beds are thus arranged in the new hospital ward on Governor's Island, New York harbor.

Finally, and most important of all, we should remember that the most perfect hospital that can be constructed will require the persistent application of brains and energy to obtain the results desired. A skillful, careful, and energetic superintendent will obtain better results, with a comparatively poorly arranged and badly constructed hospital, than an ignorant and indolent man will effect with any building, or set of buildings, which can be devised.

A large hospital is a complicated machine, which cannot be made to work automatically, but of which the several parts require constant adjustment and attention to prevent the production of some of the very evils which it is designed to remedy. If constant skilled supervision is not made an essential and integral part of the hospital organization, the cheaper and more easily destroyed the institution is the better.

HOSPITALS AND THEIR CONSTRUCTION. — THE PRINCIPLES WHICH SHOULD GOVERN IN THE LOCATION, DESIGN, MATERIAL, GENERAL MANAGEMENT, AND DURATION OF USE OF HOSPITALS.

BY JOHN M. WOODWORTH, M. D.,
Supervising Surgeon-General, U. S. Marine Hospital Service.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 10, 1874.

Primary Object of Hospitals. — If the sick and injured could receive care and treatment in comfortable, well-regulated homes, there would be no need of hospitals. But this being impossible in the present state of society, hospitals are established, for many reasons it is true, but the fundamental object for their existence, is the aggregation of patients under such conditions that a relatively small number of medical attendants and nurses may suffice for their care and treatment.

Some of the Hurtful Influences of Hospitals. — With this aggregation of patients, however, come certain evils which, it is true, exist to a greater or less extent wherever human beings are congregated, no matter what their condition. While it is conceded that the death-rate among the dwellers in cities is greater than among those whose bodily emanations are diluted by the abundance of air made possible by comparative isolation, it needs no argument to convince even the casual observer of the pernicious influence of the elements which are given off from the bodies of the sick and wounded in the form of gases and minute solid particles. It is conceived that one of the greatest problems of hospital construction is to provide for the speedy removal of these poisonous emanations, and at the same time supply the wards with pure air of uniform temperature without subjecting the sick to injurious currents. It may be conceded that this problem cannot be fully solved, but fortunately it is true that the greater the degree to which the poisonous elements are diluted with pure air, the less the danger relatively.[1] When a ward is overcrowded, or the ventilation insufficient, the miasm generated by the patients accumulates, permeating the walls and ceilings, pervading the clothing and bedding, lodging in the cracks of the floor and on the furniture until, after a longer or shorter period, depending upon the de-

[1] "The experience of the 'March to the Sea' shows that wounded men carried in ambulances, from the day of battle to the termination of the cases, did better than in most general hospitals. The prime necessity for a wounded man is pure air, and compared with this, all questions of diet, beds, and even shelter and repose, seem to be secondary." — *The Primary Surgery of General Sherman's Campaigns*, by E. ANDREWS and JOHN M, WOODWORTH, 1866.

gree and persistency of cumulation, the ward becomes a propagating house of erysipelas, gangrene, puerperal fever, and other preventable diseases.

When the plan of ward construction is such as to make adequate ventilation impossible, a periodical vacating of such ward, and leaving it with windows and doors wide open to Nature's own disinfecting processes will tend to defer the chain of evils just cited. But in old hospitals where these diseases obtain, it is useless for the surgeon to battle against them by this means, or with disinfectants. The plastering and floors should be removed and replaced by new material, and, if the zymotic diseases still continue to appear, the only remedy is the destruction of the building. I had the honor to recommend, in my first annual report of the United States Marine Hospital Service, the building of hospitals on the pavilion plan,[1] and constructed with a view to being destroyed after about ten years' use, thus securing a minimum outlay, with the most advantageous provision for the hospital treatment of the sick. This plan has been adopted by the Government, so far as the Marine Hospital Service is concerned, and a large marine hospital is now being built at San Francisco, to which I shall have occasion to refer in the following discussion : —

Hospital Construction. — As a prerequisite, the selection of a suitable location is important. A hospital designed for the treatment of acute diseases should be so located as to be easily accessible. The site should be free from nuisances of every kind, abundantly supplied with pure, fresh water, sufficiently elevated to insure good surface and subsoil drainage, and isolated to an extent sufficient to give the grounds the necessary exposure to currents of air and the direct rays of the sun.

The hospital proper should consist of separate pavilions, each complete in itself, — one story in height preferable, — and of simple architectural design.[2] If it is desirable that a hospital should stand as a monument to the munificence of the founder, then let the executive building, kitchen, laundry, and engine-house serve this purpose, for these only should be permanent. I would construct the wards of wood, as a general rule, with an air-space in the walls. Wood structures can be made nearly, if not quite, as safe against fire as those of brick, by providing a reservoir of water near the buildings, and extending therefrom ample water-conductors for hose attachments in either end of the wards, and projecting separate perforated conductors along the ridge of each building.

The Ground Plan. — The block plan here given is a modification of the new marine hospital at San Francisco. It will be observed that the wards and the buildings devoted to the kitchen, dining-rooms, laundry, and store-rooms, are grouped around the executive building, with which they are con-

[1] Surgeon J. S. Billings, of the Army Medical Corps, also advised the construction of pavilion hospitals for this service instead of repeating such costly structures as the First Marine Hospital at San Francisco, or the hospitals at New Orleans, Chicago, Chelsea, Mass., etc.

[2] "Hitherto we have studied too exclusively architectural effect, and in our zeal to vie with other public buildings, have lost sight of the humble but sacred purpose to which a hospital is dedicated." — Stephen Smith, M. D., *Principles of Hospital Construction.*

nected by a freely ventilated corridor along which all heavy articles are easily transported from one building to another by a hand-car with noiseless wheels.

The wards are arranged on radiating (fan-shaped) lines, running as nearly as possible north and south, thereby receiving the direct rays of the sun during the larger portion of the day.

Distances between the Wards. — In determining the distance between the pavilions, the elevation of the site and the natural exposure to sun-light and currents of air, should be taken into account. An intervening distance between the buildings of double the height of the pavilions will usually be found sufficient.

Number of Floors. — The most healthful hospitals are pavilions with one floor. This is because they require less practical care to secure good ventilation. A pavilion with two floors is not seriously objectionable, provided the system of ventilation is distinct for each floor.[1] Beyond this the ventilation is apt to be imperfect, and the care and proper supervision required greater than is likely to be given.

Number of Wards to a Floor. — There should be but one ward to a floor. Cross-walls, or partitions, obstruct the ventilation, and it is not probable that the strictest care can prevent the foul air passing from one ward into another on the same floor where there is a communicating door. The only plan in which two wards on one floor are admissible is where there is a freely ventilated corridor between the wards, or the administrative offices are in the centre of the building with access to the wards right and left.

Size of Wards. — The larger the ward the greater the number of patients that can be accommodated, the fewer the relative number of attendants required, and the greater the facility of supervision. There is a limit, however, to the size of the ward, fixed by sanitary conditions. The ventilation is found to become impeded if the length of the ward is over five times the width. As a general rule, the length should not exceed four times the width. The most desirable width is 28 feet, but in no case should it be less than 25 nor more than 30 feet, and the height should be 17 feet. The latter will, however, be governed in a measure by the length of the ward, but should not be less than 14 nor more than 20 feet.

Cubic Space. — The amount of cubic air-space necessary to each patient depends, first, upon the effectiveness of the ventilation, and, consequently, upon the size of the ward, and next, upon the location of the hospital, whether it be located in the centre of a large city or in the open country. In a city the allowance should be not less than 1,800 feet per patient for large wards, while small wards should have a capacity of about 2,500 cubic feet per patient, for the reason that severe cases are usually placed in the small wards, and also because of the greater difficulty of ventilating them.

A matter quite as important as the cubic air-space is the superficial area allowed to each bed, which, as a rule, should be not less than 100 feet.

In accordance with the foregoing rules, a ward 28 feet wide, 17 feet high,

[1] The object sought is that the atmosphere of no one pavilion or ward should diffuse itself to any other pavilion or ward. — FLORENCE NIGHTINGALE, *Notes on Hospitals.*

and 120 feet long, will accommodate 32 patients, giving to each 105 feet of surface area, and about 1,800 cubic feet of air-space.

Small wards are necessary in connection with a large hospital, for the purpose of isolating certain patients; but, as far as possible, such wards should be independent of the large ones.

Baths and Wash-Rooms and Water-Closets.— The water-closet, bath-room, etc., should be separated from the ward by a well-ventilated passage. In the plan of the ward which is here given the building for these purposes is shown attached to one corner of the ward, nearest to which is the wash-room, provided with porcelain vessels supplied with hot and cold water. Next beyond is the bath-room, which has a bath-tub, sitz, and steam-bath, and a marble table, which is convenient in treating cases of sun-stroke, etc. The room containing the water-closets should be separated from the passage to the ward by a door fitted to swing both ways, and which should always remain closed when not in use. The basins with syphon-traps should be well supplied with water, and arranged with close-fitting covers, and a steam-pipe opening within the inclosure to enable the basin to be disinfected from time to time by steam. The sink for ward-slops, etc., should be in the same apartment with the water-closets. The water system for closets, although attended with many disadvantages, is believed to be preferable in large hospitals, provided the sewerage is good and the drain properly ventilated. The latter can be accomplished by carrying the soil-pipe, full size, through the roof and leaving it open for the escape of all gases.

Patients' Day Room.— It is desirable to have a room connected with each ward where the patients who are well enough to leave their beds may sit and read or engage in harmless pastimes.

Nurses' Rooms.— The nurses' room should be placed near the entrance to the ward, and provided with a window which commands a view of its entire length. By this means the supervision by the nurse is made easy and more effectual, which is quite essential to the proper care of the sick. Patients are often saved from serious mischances by the timely interference of the nurse, so that the importance of this is obvious.

Notwithstanding a general dining-room may be provided, it is desirable that there should be a room connected with each ward for this purpose, which should be supplied with a small range for special-diet cooking, preparing fomentations, etc.

Materials for Floors.— Hospital floors should be made of a compact, close-grained wood, such as cherry, oak, or ash, and with the joints filled with white lead in oil to insure an impervious surface. It is important to fill the pores of the wood to prevent the floor from absorbing or holding water. This may be accomplished by laying on with a brush either paraffine dissolved in one of the cheap hydrocarbon oils, or linseed oil, or beeswax. If linseed oil[1] is used, it should be boiled, as in this form it becomes perfectly hard in a short space of time. The old custom of scrubbing or

[1] It should be remembered that old cloths saturated with boiled linseed oil ignite spontaneously in a few hours, especially if confined, and therefore should be burned as soon as used.

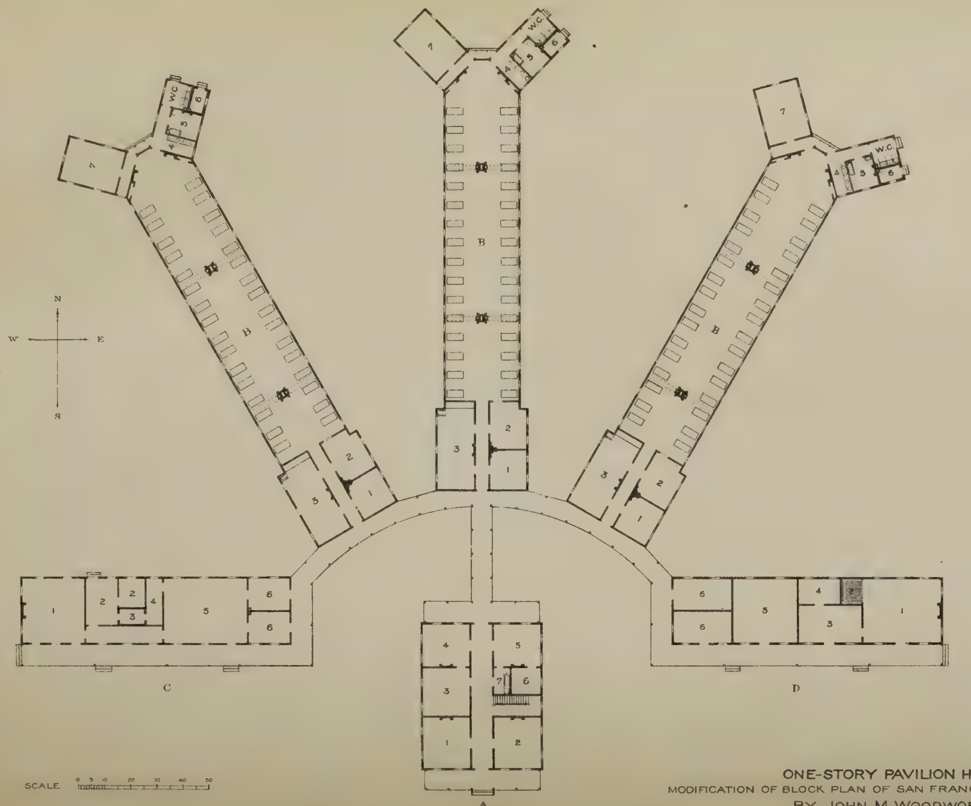
A _ EXECUTIVE BUILDING
- 1 RECEPTION ROOM
- 2 SURGEONS OFFICE
- 3 LABORATORY
- 4 DISPENSARY
- 5 OPERATING ROOM
- 6 TEMPORARY WARD
- 7 BATH ROOM

B _ WARDS FOR 32 BEDS
- 1 ISOLATION WARDS
- 2 NURSES ROOMS
- 3 WARD DINING ROOMS
- 4 LAVATORIES
- 5 BATH ROOMS
- 6 BOILER ROOMS
- 7 DAY ROOM

C _
- 1 KITCHEN
- 2 STORE ROOMS
- 3 REFRIGERATOR
- 4 PANTRY
- 5 GENERAL DINING ROOM
- 6 STEWARDS & EMPLOYÉS DINING

D _
- 1 LAUNDRY
- 2 DRYING ROOM
- 3 LINEN & MENDING ROOM
- 4 BED ROOM
- 5 PROPERTY STORE ROOM
- 6 EMPLOYÉS SLEEPING ROOMS

E _ SURGEON'S HOUSE



ONE-STORY PAVILION HOSPITAL.

MODIFICATION OF BLOCK PLAN OF SAN FRANCISCO MARINE HOSPITAL.

BY JOHN M. WOODWORTH, M.D.

SUPERVISING SURGEON-GENERAL

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

scouring ward floors with soap and water or strong alkalies should be abolished, as alkalies undoubtedly favor the growth or propagation of disease germs.

Walls and Ceilings. — Scarcely less than the floors, the walls, and ceilings of a hospital require a smooth, hard, and, as nearly as possible, non-absorbent surface. That plastered walls absorb organic effluvia, and become poisonous to the occupants of the building, abundant examples prove. The Jews, the earliest hygienists, understood this subject, and applied a practical remedy. They scraped the walls and carried the dust "without the city into an unclean place" (Lev. xiv. 39–45); and when this did not suffice, they tore down their stone houses and disposed of the stones, mortar, and timber in the same way. Until some better material for covering walls is discovered or invented, it is believed that a smooth lime and sand plastered surface, painted with several coats of lead in oil, or frequently "whitewashed" with lime, and periodically scraped, will give as good results as any plan now used. The process of painting or scraping and "whitewashing" the walls would necessitate the vacating of the ward for a time, but this is desirable, and should be resorted to periodically in all hospitals. It seems almost superfluous to add that the walls should be free from all unnecessary angles and ornamentations upon which dust would be liable to lodge. The wood-work of a ward should be severely plain, so as to be easily cleaned. Pine, covered with several coats of shellac varnish, answers the purpose well, and is economical.

Light, Heat, and Ventilation. — The windows of a ward should be opposite each other, and arranged at such intervals that not more than two beds need be placed between any two of them. Such an arrangement affords abundant light, which is as necessary for man as for plants. In the plan of the San Francisco marine hospital the windows are three feet wide, seven feet apart, and come within three feet of the floor. Over each window there is a large transom, which may be opened to any degree, or closed, by means of a cord and pulley. By opening every other transom, and raising the opposite corresponding window from below a few inches, placing vertically on the sill a board about twice as wide as the opening, and a few inches removed from the window, a free interchange of the outer and inner air may be obtained without exposing the patients to direct draughts.

This mode of ventilation can be used to any considerable extent only when the temperature without is mild. The open fire-place is the best ventilation of a ward when the weather is such as to render it necessary to keep the windows and doors closed, and no ward should be without an open grate, no matter what other mode of heating is adopted. A plan of heating and ventilation is happily combined in the open fire-places in use at the Herbert Hospital, Woolwich, England,[1] whereby the chimney is made to pass under the floor, and, on reaching the outer wall enters and passes up through the centre of the fresh-air flue, which opens into the ward near the ceiling. By this arrangement the outer fresh air is warmed several degrees in its passage to the ward, thus utilizing to some extent the escaping heat of the chimney.

[1] Douglas Galton, C. B., *On the Construction of Hospitals.*

Drainage and Sewerage. — All drains should be ventilated. This is best accomplished by continuing the main drain-pipe (into which the lesser ones enter) straight up through the top of the building. The drains should not pass under any portion of the hospital, and consequently must not be placed in the outer walls. Care should be taken that no fresh-air supply-flue opens near the sewer.

Kitchen. — The kitchen and provision store-room should be separated from the wards. Properly cooked food is a desideratum of primary importance in a hospital, and in order to secure it the kitchen should be provided with adequate facilities.

Laundry. — While it may be admissible under certain circumstances to place the kitchen in the same building with the wards for the sick, the laundry should never be so located,[1] but should be sufficiently remote from the wards to avoid contaminating the air breathed by the patients. The room devoted to washing the linen should be of ample size, well supplied with water, and provided with means of ventilation adequate to the speedy removal of steam. The soiled linen should be removed to the wash-house as soon as taken from the beds or persons of the patients, and as soon as washed, dried, and mended, should be classified and laid on an open frame-work to admit of a thorough airing.

Executive Building. — The executive building should be centrally located so as to admit of easy and rapid communication with all of the other buildings, and with which it should be connected by electric wires. It should contain the office of the surgeon, a reception-room, a dispensary and laboratory, and may accommodate the operating-room. The executive building, as provided in the plan of the San Francisco Hospital, contains the rooms named, and connected with the operating rooms is a wash and bath room, and a small ward for the temporary use of patients after operations. In the second story of the executive building are the sleeping apartments of the steward, apothecary, etc.

Question of Cost. — If nothing else could be urged in favor of the pavilion plan, the tax-payer will not fail to appreciate the *argumentum ad crumenam* to be found in the well-considered statement that such a hospital as I have indicated can be entirely built, and the wards destroyed and rebuilt every ten years for the simple interest on the sum necessary to originally build the old-fashioned orthodox hospital of like capacity, leaving the item of repairs to such a structure out of consideration.

Having thus enumerated the chief points to be considered in establishing a hospital, there remains only to consider the question of its administration when completed, and although of quite as much importance as correct construction, the whole subject may be summed up in a very few words.

Whether there be a board of managers, composed of non-professional men, or of surgeons and physicians, or of both, there should be one executive head, who should be a competent medical man — one who is capable of

[1] Dr. Billings has devised the plan of placing the laundry on the upper story of the executive portion of the hospital building, an arrangement which promises to obviate the necessity for a separate building for laundry purposes.

properly classifying the patients and managing the general hygiene of the hospital. For, notwithstanding a hospital may be constructed on the most approved economic and sanitary principles, both its economical administration and the results of its clinical treatment will depend upon the professional acquirements, business ability, and personal integrity of this officer. When the proper man is found, he should be paid a salary such as the office deserves. To fill such positions, as they sometimes are filled, for political considerations, or for qualifications other than those of competency and fitness, should curse any man or body of men, who, by so doing, jeopardize the lives of their fellows.

HOSPITALISM AND THE PRINCIPLES OF HOSPITAL CONSTRUCTION.

BY STEPHEN SMITH, M. D., OF NEW YORK.

PAPER SUBMITTED TO THE ASSOCIATION, IN ACCORDANCE WITH RESOLUTION AT THE MEETING IN PHILADELPHIA, NOVEMBER 13, 1874.

HOSPITALS may be classified as follows: Military, Civil, and Quarantine.

Military Hospitals are designed to meet the exigencies of war. In early periods they were regarded as necessary to relieve armies of the incumbrance of the sick and wounded. This object was most effectually accomplished by quartering the sick on cities through which the army passed. In later periods, when a medical service was organized, the military hospitals were permanent buildings at a distance from the field of active operations, to which the sick and wounded were transported. This led to the massing of the sick at certain centres, and, as a consequence, to an enormous mortality. The depletion of armies and the consequent failure of military campaigns on account of sickness, frequently arising from the endemic prevalence of new and fatal diseases, made it a matter of vital importance to governments engaged in war to determine the best methods of treating the sick and wounded during military operations. Largely through the observations of Pringle, in the middle of the eighteenth century, it was established that the great mortality in military hospitals is due to — (1) the aggregation of the sick; (2) deficient ventilation of hospital buildings; (3) the permanent character of those buildings; (4) defective methods of removing excreta. Every great war since that period, has confirmed these conclusions; but it was not until the Crimean war proved on a large and most expensive scale, the absolute necessity of practically applying them, that they received due consideration. From that period the military establishment has been governed by the true principle which underlies successful hospital management; namely, "the object sought in the construction of a hospital is the recovery of the largest number of sick men to health in the shortest possible time, and to this end everything else is only subsidiary."[1] The military hospital of to-day is characterized by — 1. the healthiest obtainable site; 2. simplicity of construction; 3. natural methods of ventilation; 4. separation of the sick; 5. thorough destruction of excreta by disinfection; 6. economy of administration; 7. severity of discipline.

Civil Hospitals are the outgrowth of Christian charity. They are designed to furnish the sick poor comforts and care which they cannot obtain at home. The principle which has generally governed in their foundation and

[1] Barracks and Hospital Commission.

management is that of the church establishment; namely, *Relief to human suffering.*

In location they originally sought proximity to the Church; in construction they imitated its imposing and elaborate architecture; in management were expensive; in discipline lax. To shelter the largest number of sick in the least possible space, was the rule in management, and the logical result was enormous mortalities. These abuses culminated in the great hospitals of Europe, especially in Hôtel Dieu, Paris, in the latter part of the past century, and led to much discussion of the methods of reform. The first successful effort at reform was the erection of the New York Hospital 1773–75, which embodied most of the features of the approved hospitals of the present time.

1. It had a suburban location.
2. The site was the most elevated of the district.
3. The wards were, (*a*) detached; (*b*) parallelogram in form.
4. The ventilation was by opposite windows and holes in the wall.
5. There were eight patients to a ward, (*a*) each patient had 1,974 cubic feet of air space; (*b*) 106 square feet of surface area.

In 1788, a commission appointed by the Academy of Sciences, of France, to prepare plans for the reconstruction of the Hôtel Dieu, reported.

That report contained the first definite statement of the more important principles of hospital construction. They were as follows: —

1. Separation of wards from the administration by independent buildings.
2. Reception building in front, administration building in the centre, and wards at the extremities of the plat.
3. The buildings for wards were to be three stories in height, one hundred and sixty-eight feet in length, and twenty-four feet in width; thirty feet of one extremity to be wider, and devoted to ward services; heighth of ward fourteen feet; windows to extend from the ceiling to the level of the beds.
4. Each ward was to contain thirty-four to thirty-six beds; each building one hundred and six to one hundred and eight beds; each ward was to have its own baths, lavatories, kitchen, stove, scullery, and every other convenience — each ward being thus an independent hospital.
5. The ward buildings were to be separated 72 feet, the space being occupied as a garden, without trees or shrubs, and used as a promenade for patients.
6. The ward buildings were to be connected by a corridor, not elevated above the basement.

But neither the example of the New York Hospital in this country, nor the able report of the French Commission was followed during the next three fourths of a century by any important improvements. The war of the Crimea again gave such prominence to the defects of military hospitals, that there followed, chiefly through the writings of Miss Nightingale, a wide discussion of the whole subject of hospital construction and management. The result of this discussion has been a general awakening of all civilized countries to the imperfections of existing hospitals, and a revival of the principles established by the French commission.

But civil hospitals are still largely under the control of influences which

tend to render them subservient to other purposes than the recovery of the sick in the shortest space of time. The location is made subordinate to the convenience or purposes of its patron, whether a church, a medical school, or a deceased philanthropist ; in construction it illustrates all that is objectionable in the gloomy, unventilated, but extremely expensive church architecture of the Middle Ages ; the management is lax and often extravagantly costly.

Quarantine Hospitals are designed for the protection of the public health by the isolation of the sick of contagious diseases. The principle which governs in their foundation and management is that certain diseases are communicable from the sick to the well through the medium of a germ, or particle of infectious matter, conveyed by direct contact of persons, or clothing, or air, or water. The most effectual preventive measure has been such isolation of the sick that the contagium could not reach the well by any of these methods. To isolation disinfection has latterly been added ; but it has been imperfectly applied, the reliance being solely upon isolation.

The present teachings of science, experience, and philanthropy are, that the *first* object in the establishment of hospitals of every variety should always be the restoration of the sick to health in the shortest time practicable, and that the *second* object should be to render each in its appropriate sphere subservient to the highest interests of society.

I. *Military Hospitals* should be classified as field, base, and convalescent hospitals.

1. The Field Hospital should be a tent amply provided with everything needful for the immediate care of the wounded.

2. The Base Hospital should be a tent with every necessary appliance for operations and dressings.[1]

3. The Convalescent Hospital should be a tent or barrack, and as regards the class of diseases admitted, it should be special, and be located and supplied accordingly.[2]

II. *Civil Hospitals* should be established for the purpose, *first*, of restoring the sick poor to health in the shortest time practicable by supplying them with conditions essential to recovery, which they cannot obtain at home ; and, *second*, of promoting sound medical education, and skilled nursing. A hospital designed to accomplish those objects will have the following peculiarities : —

1. In location it will be suburban, or, if in a populous district, so surrounded with open grounds, graded and cultivated with trees, that the air of its wards is not rendered impure by any noxious emanations, whether from unwholesome trades, collections of filth, open sewers, or dense populations.

2. The soil will be porous, and so drained as never to contain more than the natural soil-saturation.

[1] The "Post Hospital" is in no respect essentially different from a convalescent hospital, and its perfection consists in simply combining the requirements of the base and the convalescent hospitals.

[2] Ibid.

3. The population per acre will not exceed fifty persons.

4. The wards will admit sunlight to every portion, and the air will be properly warmed and entirely changed every hour without sensible currents, (*a*) by natural means in small detached buildings, (*b*) by aspiration or the fan in buildings massed together.

5. The diseases of the sick will be classified according to their germinal origin, each ward being devoted to diseases having a common cause.

6. The sick in one ward will not inhale air respired by another until it is disinfected by natural or artificial processes.

7. Excreta of the sick, whether of lungs, skin, kidneys, or bowels, will be so effectually devested of their injurious properties that the air cannot be polluted by them.

III. *Quarantine Hospitals* should be established, *first*, to restore the sick of contagious diseases; and, *second*, to protect the public health. They should not be located at a distance from populations simply to secure isolation, but only because such location is most convenient and best adapted to restore the sick. They should be so arranged as to control contagious diseases in the midst of populous districts by —

1. Such construction as will admit of the total destruction of the contagia in the air of the ward before it escapes.

2. Cleansing and disinfection of the patient and his clothing.

THE FACTORS OF DISEASE AND DEATH AFTER INJURIES, PARTURITION, AND SURGICAL OPERATIONS.

By S. D. GROSS, M. D., LL. D., D. C. L. OXON.

A DISCOURSE BEFORE THE AMERICAN PUBLIC HEALTH ASSOCIATION, AT ITS MEETING IN PHILADELPHIA, NOVEMBER 10, 1874.

SCIENCE is the patrimony of mankind; she stretches forth her right hand and her left in her efforts to develop knowledge, and to utilize it for the benefit of the human race. Until within a comparatively recent period philosophers and scientists were contented to occupy themselves with the study of the grosser elements of matter, as they appeared to the unassisted eye; but in our generation new objects have engaged their attention, and instruments, of the most delicate construction, have been devised for the investigation and examination of the most minute entities, the very existence of which was not even suspected by the most enlightened of our forefathers. How far the facts revealed by these researches have contributed to the extension of our knowledge of sanitary science is familiar to every intelligent person. Without their aid we should still literally be groping in the dark respecting many points of essential importance to the health and the lives of the people. The dangers which constantly beset us in our daily walks in city, town, and country, are better understood; the noxious weeds which everywhere so cunningly intertwine their leaves with those of the rose and the lily are more easily discerned; and if, in consequence of the knowledge thus derived, we do not live longer, certain it is that we live more securely and more happily.

The great enemies to health and life, after injuries, parturition, and surgical operations, are septicæmia, pyæmia, erysipelas, and hospital gangrene, diseases all more or less intimately connected with, if not directly dependent upon blood-poisoning, itself the result of the influence of vitiated air acting upon the part and system, the pernicious effects being so much the greater in proportion to the crowded condition of a hospital, and the tainted state of the atmosphere generated under these circumstances. Even healthy persons, subjected only for a short time to the foul emanations of the crowded wards of such an institution, must inevitably incur great risk to health and life; and, if this be the case, it is easy to perceive what must be the fate of those who, previously to their admission, suffered from severe shock and loss of blood, the great predisposing causes to pyæmia, septicæmia, erysipelas, and gangrene. The systems of such persons may be compared to tinder which the slightest spark may kindle into a devouring flame, which no human agency can arrest or control. Persons exhausted by protracted suffering, whether from inadequate supply of food, dissipation, in-

temperance, unwholesome occupation, loss of sleep, hard study, mental anxiety, or any cause whatever, are, if brought under the influence of a contaminated atmosphere, liable to be affected in a similar manner ; that is, the system is in a state predisposed to disease, and only requires to be brought into contact with some poisonous material ; as, for example, that of scarlet fever, typhoid fever, small-pox, or some other zymotic malady, to contract the specific distemper. When the air is unusually tainted, the stoutest and healthiest individuals may, even in a wonderfully short time, contract fatal disease, the system being literally overwhelmed by the specific poison, as we see occasionally exhibited in seminaries, colleges, workshops, factories, and similar establishments. Man and the domestic animals are equally liable to suffer in this manner from these and other causes. The rinderpest, or cattle-plague ; the epizooty, which prevailed so extensively two years ago among the horses of this and other cities ; the hog-cholera, so well described by Dr. Sutton of Indiana ; and the epidemics that occur, from time to time, among dogs, cats, rabbits, and poultry, afford ample illustration of the truth of my statement. These distempers, which, like cholera, scarlatina, typhoid fever, and small-pox in the human subject, are all of a zymotic nature, and are dependent, for their development and propagation, upon the existence of a peculiar poison, supposed, by common consent, to be contained in the air.

The identity of erysipelas and puerperal fever — an opinion long ago entertained by certain pathologists — is now generally recognized as an established fact. I am myself thoroughly convinced of its truth, and I am equally satisfied of the identity of both these affections and of septicæmia, pyæmia, and hospital gangrene. The poison of any one of these diseases is capable of producing all the others. Puerperal fever is, in the parturient female, what erysipelas, pyæmia, or hospital gangrene is in the male after serious wounds and injuries. The secretions of the overworked and irritated uterus and vagina find their way either by absorption through their mucous surfaces, or directly through the mouths of the dilated uterine veins, into the system, poisoning thus both the blood and solids, and producing a state of things speedily followed by death. The most irrefragable proof exists that puerperal fever is a contagious disease, communicable by direct contact, or indirectly through the agency of the clothes worn by the medical attendants, nurses, and friends of the patient. Many a practitioner has carried the poison of this disease about in his hands, his gloves, or his clothes. A medical gentleman, at one time largely engaged in obstetric practice in this city, lost in the course of a few months upwards of thirty women from having carried the virus from one house to another, while the patients of other practitioners, even of those living in the same neighborhood, entirely escaped. His paths were literally strewn with dead women, and such was the effect which these melancholy disasters exerted upon his reputation as a professional man that he lost all his practice, and drove him in disgust from the city. Many similar cases could be adduced if time permitted. It was in view of these occurrences, so appalling in their consequences, throwing not only whole families but sometimes even whole communities into mourning,

that a Boston gentleman, Oliver Wendell Holmes, gave to a most admirable paper, which he published upon this disease in 1850, the significant title of "Puerperal Fever, considered as a Private Pestilence." In every lying-in hospital puerperal fever occasionally prevails as an epidemic, carrying off large numbers of women.[1]

How long hospital gangrene has existed as a distinct disease we have no means of determining. That it has, in modern times at least, been the scourge both of civil and military hospitals is well known. During the last century it prevailed more or less extensively in some of the civil hospitals of France, assuming occasionally an epidemic character, and likewise on board of some of the English transports that visited our coasts during the Revolutionary war. In one of these vessels, stationed at New York, upwards of two hundred cases occurred, and of these many proved fatal, death in a considerable number having been due to gangrene of the stump after amputation. The disease also committed great ravages at the Cape of Good Hope, in the West Indies, and in Spain during the Peninsular campaigns. The French army suffered severely from it in the Crimea, and during our late war many of our military hospitals, especially those at Annapolis, Washington City, Baltimore, New York, Louisville, and Frederick, Maryland, were more or less extensively infested with it. In the Philadelphia Hospital sporadic cases of the disease occurred every winter during the seven years of my connection with that institution, chiefly among old, broken-down patients, the subjects of chronic sores, and of a scorbutic state of the system.[2]

As preventives of the diseases incident to persons laboring under wounds and injuries, confined in hospitals, of necessity more or less crowded, various kinds of dressings have lately come into use, a few of which, from the attention they have attracted, may be appropriately noticed here; promising that, while some of them are exceedingly complex, others are so simple as hardly to merit the name. The hermetically sealed dressing,[3] as I shall

[1] I may here state that there was at one time a department of the Pennsylvania Hospital in this city, appropriated to puerperal women, which was formally closed by the managers in 1855, on account of the impossibility of keeping the wards free from this horrid disease.

[2] To show the rapidity with which this disease is capable of doing its work, I may state that I had under my charge, at the George Street Hospital in this city, during the late war, a man who had been slightly wounded by a bullet in the left elbow at the battle of Chancellorsville, and who, after having been progressing most favorably for about ten days, was suddenly seized with gangrene, which spread so rapidly that he died the following night. The frightful mortality which hospital gangrene occasionally produces where persons are crowded together in large numbers on shipboard, is well illustrated by what occurred on one of the French transports in the Mediterranean during the Crimean war, which, within thirty-eight hours, on her voyage from the South of France to the Bosphorus, threw sixty bodies, dead of this disease, into the sea. In all such cases the disease is of the true contagious type, attacking indiscriminately open wounds, cicatrices, and stumps; the system is literally overwhelmed by the action of the virulent poison, and the air is completely surcharged with pestilential germs, fastening themselves upon everything with which they come into contact.

[3] This method was foreshadowed in the seventeenth century by the practice of a famous Englishman, Sir Kenelm Digby, better known as the knight of Montpelier, who, in 1651, published a discourse upon the cure of wounds by what he termed the sympathetic powder,

call it, or, as it is generally designated, the *antiseptic* mode of treatment of wounds has been brought prominently forward by Professor Lister, of Edinburgh. He has rendered himself famous by the advocacy of the method of treatment of wounds and compound fractures and dislocations; many surgeons, especially in Europe, have bowed at his shrine, and many controversies have taken place respecting it during the last six or eight years. Notwithstanding, however, all that has been said and written upon the subject, the utility of the antiseptic treatment is still as much as ever a matter of dispute. As for myself, I have long been of the opinion that its good effects are due, mainly, if not wholly, to the care which is taken in cleansing the wound of blood and foreign matter, in approximating its edges, deep as well as superficial, in excluding the air, and in keeping the parts and system at rest, in a pure atmosphere, and the patient upon proper diet, until union has occurred. That carbolic acid, carbolate of soda, and kindred preparations are excellent disinfectants and deodorizers is unquestionable; but that they possess the virtues ascribed to them by Mr. Lister and his followers is in the highest degree improbable. According to the Scotch surgeon, these agents act as germicides, destroying, as the term implies, the animalcules supposed to be floating about in the atmosphere, and to insinuate themselves, at every opportunity, into the interior of wounds and the cavities of abscesses after the evacuation of their contents. Now, I shall not stop here to reopen the question of the germ-theory, or whether there are such entities as germs or not; it will suffice for my purpose to state that some surgeons, of at least equal intelligence with Mr. Lister and his disciples, discard dressings altogether, leaving the wound freely exposed to the air, and relying solely upon rest, cleanliness, and other hygienic measures for a speedy and

founded upon the doctrine of the existence of effluvia and of corpuscles floating about in the air, the mutual affinity of similar structures, and other notions not altogether in accord with those of our day. The treatment suggested and practiced by this learned and eccentric person, a non-professional gentleman, embraced two distinct principles: one relating to the wound, the other to the weapon with which the wound was inflicted. As it respected the former, after all extraneous matter had been removed, the edges were most carefully approximated, when the affected parts were bound up in fine linen, arranged in such a manner as effectually to exclude the air. In fact, the wound was hermetically sealed; and in this condition it was generally left until the end of the sixth or seventh day, when the wound, unless extremely large, was usually found to be completely repaired, little or no suppuration having occurred in the interval. The only application made during the whole of the after-treatment was made to the weapon itself, which, suspended near the patient's bedside, was anointed at least twice a day with some peculiar salve, supposed by the sufferer to be endowed with peculiar sanative properties. Sometimes, as when the weapon could not be found, the ointment was applied to the patient's bloody clothes. Digby has been much ridiculed on account of this mode of treatment, very unjustly, however, as I conceive; for it must be recollected that as he lived in a superstitious age, the method was well calculated to quiet the patient's mind, and induce him to remain at rest, while the wound, carefully bound up, was undergoing the healing process. He had too much sense to believe for one moment that there was any special virtue in anointing the weapon which had inflicted the injury. From this procedure the antiseptic dressing devised by Professor Lister differs, first, in the employment of carbolic acid and other disinfectants; and, secondly, in dispensing with any application to the weapon, the world having become a little wiser in this respect than it was two hundred years ago.

successful cure. This plan of treatment, which is extensively pursued at the great hospital at Vienna, in the words of Professor Billroth, has furnished admirable results in the hands of a number of English and Continental practitioners, and recommends itself by its great simplicity. Professor Rose of Zurich has employed it in upwards of one hundred cases with the most gratifying effects.[1] Much of the success of the treatment of wounds depends, first, upon the manner in which they are made; secondly, upon the care with which they are cleansed; and, thirdly, upon the manner in which they are approximated. All these circumstances have a direct and positive influence upon its future well-being and final result. It may be assumed, as a general law that, all other things being equal, the rapidity with which a wound heals will be in direct proportion to the absence of contusion, foreign matter, and rude handling. A wound made with the surgeon's knife will be more likely to do well if the tissues have been cut smoothly than if they be divided roughly, as when the knife is dull or rusty. A dirty knife may even inoculate a raw surface, and so also a dirty finger, with the poison of a specific disease. A dirty or unwashed ligature, or a ligature roughly applied,

[1] The practice of most surgeons, in the class of injuries under consideration, is extremely simple; indeed, it may be said to be the very quintessence of simplicity. My own plan, for instance, for many years has been, after the wound has been thoroughly cleansed and approximated, to cover it merely with a light compress wet with olive oil, and supported with a loosely applied bandage. Under this management the largest and deepest wound frequently heals in an almost incredibly short time with hardly any suppuration. Early last July I amputated at its lower third the thigh of a stout, muscular person, forty-six years of age, who, five days previously, had received a compound comminuted fracture of the leg from the kick of a horse. At the time of the operation mortification of the foot and ankle had already taken place. Notwithstanding this, under good nursing, pure country air, and the judicious management of Drs. Stebbins and McClurg, the large wound healed very rapidly, and the entire quantity of pus discharged during the after-treatment did not, I am assured, amount to one ounce. In September last, I tied the external iliac artery of a tall, slender, laboring man, thirty-four years old, for the cure of an aneurism of the femoral artery, making a wound at least four inches in length, and embracing, of course, not only the entire thickness of the wall of the abdomen, but also the border of the pelvis; and, although no antiseptic measures were employed, the quantity of pus discharged in the twenty-four hours at no time exceeded one drachm. The only dressing, from first to last, was a compress wet with olive oil, confined with a few strips of adhesive plaster. These cases, which are typical of many others that have come under my personal observation, afford a beautiful illustration of the value of simple dressings, unassisted by antiseptic agents. Sir Astley Cooper attained the same object, in cases of compound fractures and dislocations, by covering the wound with a pledget of lint, saturated with the patient's blood; and Mr. Bennion, a surgeon of Shropshire, England, derived great benefit, in the treatment of such accidents, from the employment of the compound tincture of benzoin, the Friars' balsam as it was formerly called, a remedy much trusted in the olden times in injuries of this description. Dr. Addinell Hewson, one of the surgeons of the Pennsylvania Hospital, has used with signal advantage what he calls the "earth dressing," clean dirt, as the country housewife would term it. Lord Palmerston's aphorism was that "dirt was soil in the wrong place;" but in the hands of Dr. Hewson, it is evidently soil in the right place. Dry earth, as prepared by Dr. Hewson, is absorbent, deodorant, and antiseptic, contains an abundance of ozone, allays putrefaction, and rapidly decomposes poisonous matter in the living as well as in the dead body. Of one hundred and three cases of wounds, compound fractures, burns, ulcers, and fœtid abscesses, treated with dry-earth poultices, renewed whenever the discharges had percolated through them, there were only thirteen deaths, of which nine were from pyæmia; a result eminently creditable to any mode of treatment whatever.

may prove a source of irritation, sadly interfering with the healing process. Modern surgeons, the world over, pay much attention to the cleansing of wounds. The slightest particle of extraneous matter, even the finest hair, will inevitably interfere with the adhesive process. Blood acts in a similar manner. If allowed to remain in the wound it is soon decomposed, and thus not only opposes union, but some of the putrescent particles being carried with the system, and so poison the entire body, it may become a prominent factor in the production of metastatic abscess. For this reason a wound, whether the result of accident or made with the surgeon's knife, is always cleansed with the greatest possible care.[1] Great injury is often inflicted upon a wound in the attempts to approximate its edges. A blunt, dirty needle, coarse, unwaxed thread, and rude manipulation, are ill calculated to favor reunion. A bandage applied unevenly or too tightly cannot fail to act prejudicially. Then, again, rest is of paramount importance, and not only rest but elevation and easy position of the parts. If all these things are attended to, and the patient has, in addition, the advantage of good air, good nursing, and good medical attendance, it is difficult to conceive how, in ordinary cases, a wound should fail to do well, or the system incur any risk from the ingress of putrescent matter. Immense numbers of persons die from defective ventilation and cleanliness, and I am quite sure that far more mortality is occasioned, in cases of injuries and of parturient women, by bad nursing than there is by bad doctoring, bad as the latter unquestionably often is.[2] When foul animal or vegetable germs enter the sys-

[1] Some of the French surgeons are in the habit of effecting this object with alcohol. At the Beaujou Hospital in Paris, Dolbeau uses nothing else. My colleague, the elder Professor Pancoast, long ago instituted the practice of washing wounds with a strong solution of chloride of zinc, a practice usually but erroneously ascribed to Mr. De Morgan of the Middlesex Hospital, London. I seldom use anything else than cold water. At the Pennsylvania Hospital, where, by a peculiar arrangement attached to a carriage, invented by Dr. Thomas G. Morton of this city, the wound is thoroughly washed out with a stream of water passed through a gum elastic tube, that gentleman informs me that pyæmia, erysipelas, and gangrene are of rare occurrence since the adoption of this procedure, even after the most severe accidents.

[2] In dressing wounds, especially fresh ones, great harm is frequently done by unwashed fingers and the use of dirty material; and it is easy to perceive that the best skill in the world would be frustrated by a foul sponge. The most assiduous attention and the most consummate skill are of little avail in the absence of pure air, proper food, and careful dressing. The inflammatory secretions, if allowed to be pent up even for a short time, become filled with the germs of the agents of decomposition, which soon begin their dangerous work, and are invariably productive of mischief, often grave and sometimes fatal. The destructive effects from the entrance of pus, or purulent fluid into the system, is a matter of daily observation in surgical and obstetric practice, especially among the inmates of crowded hospitals; but, as if this were not sufficient to settle the question, recourse has been had to experiments upon the inferior animals. Thus, it has been ascertained that, if putrid pus, taken from the human subject, be injected into the vein of a dog, or even under the skin into the connective tissue, in quantities varying from half a drachm to a drachm, violent symptoms, such as gastro-intestinal irritation, and great depression of the vital powers, will speedily ensue, followed by death in from five to six days. Similar effects result, as shown in some experiments performed by Gaspard, when an ounce of putrid water, in which beef has been macerated, is thrown into the artery of the thigh of a dog. The operation is soon succeeded by great restlessness, high fever, thirst, gastric and intestinal irritation, and all the phenomena of blood-poisoning, the case usually ending fatally within the first three or

tem through a large wound, as, for example, the stump of an amputated limb, or when the foul secretions that are under such circumstances, formed in a wound are carried into the system, they become at once factors of pyæmia, erysipelas, and gangrene, and, consequently, causes of death, particularly so if there be an impure state of the air from overcrowding, defective ventilation, or want of cleanliness; for, once admitted into the system, few, if any, ever recover. The baneful fluid acts either as a direct poison, weakening the powers of life, and more or less rapidly destroying it; or it causes death by decomposing the blood, and inducing the formation of blood-clots, technically called thrombi, which, obstructing the circulation, occasion death by arresting the functions of organs essential to life, or by becoming so many centres for the development of destructive abscesses, often so numerous as to have received the significant appellation of multiple.

The interesting question here arises, what is the essential nature of the poison generated in decomposing animal fluids, such, more especially, as are formed in wounds, and in the open surfaces of compound fractures and dislocations? Is it a peculiar poison, similar in principle to that of vaccinia, or small-pox, for example; or is it a poison the product of fermentation, of catalysis, or of living germs, or organisms, as bacteria and vibriones, floating about in the air, and liable to be generated, often in immense numbers, in the blood and the various secretions of the body, in cases of so-called blood-poisoning, however induced? Unfortunately here science is dumb; we literally know nothing of these things, but we do know that these animal poisons, whatever they may be, possess an astonishing power of multiplying themselves, and thus augmenting their virulence or destructive agency. That this is true is unquestionable, and it may therefore be assumed that the germs or animalcules are derived immediately and directly from progenitor or parent cells. Experience has shown that the poison of contagious and infectious diseases retains its specific properties for a long time, if not indefinitely, thus bearing a striking resemblance to the virus of vaccinia, small-pox, and of some other secretions, common to both sexes.

four days. If the body be examined after death, the blood will be found to be in a dissolved condition, the muscles softened and discolored, the gastro-intestinal mucous membrane highly engorged, and the lungs and some of the other viscera more or less disorganized. Similar results are obtained from the introduction of sulphureted hydrogen, sulphide of ammonium, and water in which vegetable matter, as, for instance, cabbage, has been macerated for some time. It has been ascertained that the blood of an animal dead from such experiments will, if introduced into a vein of a living animal, cause violent symptoms, speedily followed by death. From experiments such as these it is easy to perceive what would be likely to be the effects of disease-germs, putrescent emanations, sewer-gases, and other sources of infection so common in our houses and grounds, especially during the hot summer months. We read of whole families being cut off by typhoid fever, scarlatina, dysentery, and other complaints; and of the inmates of schools, factories, prisons, hospitals, and other establishments perishing in large numbers from blood-poisoning occasioned by defective drainage. The protracted and dangerous illness of the Prince of Wales was due entirely to the bad sewage at Sandringham; and it is well known that his father, the late Prince Consort, lost his life from blood-poisoning induced by a similar cause. Cesspools, stagnant water, decomposed animal and vegetable matter, old clothes, old furniture, old carpets, garbage, and a thousand other things, are incessantly engaged in throwing off material of the foulest character, tainting the air we breathe, the water we drink, and the food we eat; thereby, in many cases, sapping the very foundations of life.

Especially is this the case when it adheres to, or has, so to speak, found a nidus or nest in articles particularly well adapted to its reception.[1]

The poison of diphtheria is of a very subtile character, and clings with great pertinacity to particular garments, houses, and localities. The disease possesses highly contagious and infectious properties, and is easily communicated from one individual to another, especially when, from any cause whatever, there is a depraved, vitiated, or enfeebled state of the system, or impure air from bad sewage.[2]

[1] A curious, as well as instructive instance of this property of the virus of scarlet fever is related by Hildenbrand, a German writer of the early part of the present century. While visiting a patient affected with this disease, he wore a black cloth coat, which, one year and a half afterwards, he carried with him from Vienna, the place of his residence, to Polodia, where it communicated, first to himself, and soon after to the people, the disease which had previously been almost unknown in that province.

[2] Numerous instances have been recorded where the poison of diphtheria was carried from an infected town to the country, or from an infected rural district to a city, causing, perhaps, in either event, an epidemic outbreak. A melancholy instance lately occurred in England, which, from the high position of the family, elicited much sympathy, both public and professional. The young son of a nobleman who had had an attack of diphtheria in London, soon after his return home in the country communicated the disease to his sister, and she, in turn, to her mother, both dying from its effects. Several surgeons have lost their lives from diphtheria contracted from sucking the wound made in tracheotomy of persons laboring under the malignant form of the disease. Protracted vacation and thorough cleansing of a house, in such a case, does not always secure immunity from a future outbreak of the disease on the return of the occupants, such is the indestructible character of the virus, and the wonderful tenacity with which it clings to everything upon which it fastens itself.

One of the most remarkable examples of this peculiarity of disease-germs, dating back to the middle of the last century, may be said to be classical. Its story has been transmitted to us by Dr. Brocklesby, a highly intelligent English army physician. In 1758, as it would seem, many sick soldiers were brought home from the coast of France, and lodged in old houses, barns, and other buildings round Newport, in the Isle of Wight. In one of these close hovels a poor fellow, just arrived, was soon seized with putrid sore-throat, of which he died on the third day. Two other men, placed upon the same bed, without any other change than a clean sheet, soon experienced a similar fate. New bedding was now substituted, and the wood-work of the apartment scraped and thoroughly washed, when a fourth soldier was placed in it, and he also died. A second time the apartment was carefully cleansed, and the air purified with the fumes of vinegar and of burnt resin and gunpowder; but despite all these precautions, a fifth patient narrowly escaped with his life. The apartment was now vacated for eight days, when a sixth soldier, also came near perishing. Instructed by this impressive lesson, a temporary shed was now erected in the open forest, and thatched with a coat of new straw barely thick enough to exclude wind and rain, and the result was that, although one hundred and twenty sick men were confined in it, very few died. The poison of glanders, farcy, or equinia, a contagious and infectious disease common to the horse, ass, and mule, seems to possess the same virulent and indestructible character as that which is generated in wounds and open abscesses in persons confined in crowded and ill-ventilated hospitals, on shipboard, and other places. It has been found that the air of an infected stable, after all the wood-work, pavement, and plastering have been replaced with new material, and every possible precaution used in regard to cleanliness, is capable of reproducing the disease in all its former intensity. It is owing to this peculiar nature of disease-germs, to the tenacity with which they adhere to our garments and other articles, that zymotic diseases are communicated from one person to another, and from district to district, often by a solitary individual, and occasionally by large bodies of men, or by soldiers on their marches; many of the most devastating epidemics of ancient and modern times having been caused in this way.

I have already alluded to the inconceivable rapidity and power of multiplication of the poison of certain diseases. An impalpable speck of small-pox virus, inserted into the skin, is capable of developing, in a few days, an amount of matter sufficient to inoculate myriads of human beings with the germs of this frightful malady.[1] That the specific poison of cholera, scarlatina, pyæmia, hospital gangrene, and other zymotic diseases, extends itself in a ratio equally great, is a fact now generally recognized by pathologists. The sudden subsidence of these maladies as they appear in some of their epidemic forms, may be explained in one of two ways: either that the system gradually loses its susceptibility to the infection, or that certain states of the atmosphere, especially moist and cold ones, have a tendency to lead to the spontaneous decomposition and extinction of the germs or organisms, in which the specific poison resides, or by which it is fomented and communicated. The chief media by and through which this zymotic poison is conveyed from one individual to another are undoubtedly the cutaneous and pulmonary exhalations, or, in other words, the skin and the lungs. That living organic particles are constantly detached from these structures, and afterwards float about in the air, is a fact so well established as not to require any proof.[2]

Zymotic poisons or disease germs, in their various forms and relations, have probably existed from the most remote antiquity, and have no doubt

[1] Aitken's *Science and Practice of Medicine*, vol. i. p. 636, London, 1868.

[2] By an ingenious device of Pouchet, a French philosopher, the matter thus thrown off may readily be collected by forcing a current of air through a funnel with a very narrow opening, immediately below which the object-glass of a microscope with a drop of glycerine upon it, is placed. Any extraneous substance contained in the air is thus easily caught and inspected. By this method observers have, in a number of instances, discovered epithelial cells in apartments occupied by sick persons; and Eisett, in a ward inhabited by thirty-three children affected with acute granular inflammation of the eyes, detected pus-cells, the product of the diseased structures, floating in the air.* Professor Parkes, of England, has found large quantities of epithelium, derived from the skin, if not also from the mouth, of the inmates of various barracks and hospitals; and Chalvet declares that the dust collected in sweeping the wards of the St. Louis Hospital of Paris, contained from thirty-six to forty-six per cent. of organic matter, principally in the form of epithelium and pus-cells. "In all tainted atmospheres of this kind," says the former of these writers, "it would appear that the germs of infusoria abound to a much greater extent than in pure air. It seems probable, he continues, that the discovery of suspended matters of this kind will lead to most important results. The possibility of a direct transference from body to body of cells undergoing special chemical changes, is thus placed beyond doubt, and the doctrine of contagion receives an additional elucidation. It remains to be seen whether pus and epithelium cells becoming dried in the atmosphere, can again, on exposure to warmth and moisture, undergo the chemical changes which had been interrupted, or whether they would not rather break down into impalpable particles, and be then totally oxidized and destroyed. It is now generally admitted that protophytes, like the *protococcus Pluvialis*, may be dried and yet retain their vitality even for years, and may be blown about in atmospheric currents; but it would not be right to infer a similar power on the part of epithelium or pus-cells."

The idea that epithelium may retain its vitality for sometime after it is detached from the living body, or that it may regain its vitality after having been dried, would seem to be countenanced by what occurs in skin-grafting, which often succeeds quite as well when performed with scales of epidermis as when performed with true skin.

* Aitken, *op. cit.* p. 460.

invariably sprung from preëxisting foci, or centres, the succession having been kept up more or less continuously ever since, encouraged by various predisposing causes, and influenced in a thousand ways by locality, air, heat, moisture, and other circumstances favorable to their development and propagation. Like certain tribes of insects, as, for instance, the locust, they seem to have their periods of repose, lying in a dormant state until by some propitious agency, they are again summoned into activity, ready for the exercise of their destructive powers; filth of every description, especially that arising from confined and ill-ventilated habitations, and the emanations of human beings and of animals closely packed together, being the substances upon which they seem to delight to feed and grow.[1] The mortality from the effects of these poisons, in the form of what I have already so frequently mentioned as the zymotic diseases, as typhoid fever, and typhus or ship-fever, cholera, scarlatina, measles, whooping-cough, croup, diphtheria, small-pox, puerperal fever, erysipelas, septicæmia, pyæmia, and hospital gangrene, is simply appalling.

But little time is allowed me to speak of the construction and management of hospitals,— subjects at present greatly exercising the professional as well as the non-professional mind. Dating back to the fourth century, when the first institution of this kind went into operation under the auspices of that good old man, Saint Jerome, the history of most of these establishments, designed, as the name implies, to shelter the sick, the halt, the blind, and the deaf, and to relieve them of their diseases and infirmities, is, both in Europe and in this country, one of profound sadness and disappointment, of money misapplied, of care and talent misdirected. Pouteau, of Lyons, after having witnessed in the latter part of the last century, several epidemic outbreaks of gangrene in the Hôtel-Dieu of that city, in one of which he himself narrowly escaped with his life, came to the conclusion that such institutions were an evil instead of a benefit. The late Sir James Y. Simpson of Edinburgh, considered them as banes rather than blessings; and as for myself, I have no hesitation in denouncing them, as they are usually constructed and managed, as pest-houses; or, what is the same thing, although the language may sound harshly, as slaughter-pens, as necessary evils, as "whited sepulchres, which indeed appear beautiful outward, but are within full of dead men's bones, and of all uncleanness." Large wards with low ceilings and small windows imperfectly ventilated, and overcrowded, are conspicuous features of most of these edifices; and as a natural consequence, the mortality is frightful, no matter what care and skill are bestowed upon the inmates by the medical attendants and their subordinates. Where the air is so pestilential, as it often must be, the danger to limb and life must be proportionally great, even after the most trivial accidents and operations. The lying-in wards of such institutions are the constant scenes of the most deadly forms of puerperal fever or blood-poisoning; and hence no parturient woman is at any time safe, whatever means may be employed to purify the atmosphere and to guard against infection.[1]

[1] That there are exceptions to some of these institutions, as, for example, in the case of St. Bartholomew's Hospital, London, is happily true, but they are only exceptions, and

The two noblest hospitals in the world, so far as my inspection enables me to judge, are the "Lariboisière," and St. Thomas's in London. The former, erected, like the latter, at an enormous expense, with a capacity for six hundred and twelve beds, is arranged upon the pavilion principle; that is, instead of being under one roof, with free intercommunications, it is divided into four buildings, each of which is, so to speak, a separate hospital, without any open passages between them. St. Thomas's Hospital, built upon a similar plan, is a palatial edifice, situated on the banks of the Thames, opposite the new houses of Parliament, and close to Lambeth Palace, the residence of the Archbishop of Canterbury. It cost $3,000,000, and is so complete in its arrangements as to leave nothing to be desired, either as it respects its accommodations for the sick, or its facilities as a great scientific school of medicine. In this country the best constructed hospitals are the Boston City Hospital, St. Luke's, the Presbyterian, and the Roosevelt hospitals of New York, and the Episcopal Hospital and the Hospital of the University of Pennsylvania, recently erected through the munificence of private and State liberality. But, perfect as these institutions are, they will occasionally, despite the best directed efforts and the closest scrutiny and care of its medical attendants, be visited with outbreaks of epidemic distempers, and thus mar the result of many a surgical operation, and destroy numerous lives, the subjects of accidents and ordinary diseases. Such, at all events, has been the dire experience of most of these institutions from their commencement to the present time. The fault of most hospitals is that the wards are too large, and therefore liable at times to be overcrowded, much to the detriment of its inmates. Even at St. Bartholomew's, London, with the gratifying statistics of Mr. Callender, pyæmia and gangrene are occasional visitants. I am myself fully satisfied that the dangers from contagious and infectious diseases in hospitals are in direct ratio to their size and the number of their inmates, leaving out of view everything that concerns their site and internal economy. No single ward should have more than six, eight, or, at most, ten beds, and no such institution more than one hundred beds altogether, with ample grounds for out-door tents in case of emergency, whether occasioned by epidemic visitations, or

nothing more. Although this hospital is upwards of three centuries old, the statistics of operations furnished by Mr. Callender, are in the highest degree flattering; but, if the fact could be ascertained, I have no doubt it would be found that the success is due as much to the good nursing and the kind attentions of the sisters of charity, those angels of mercy who superintend the wards, as to the skill and care of Mr. Callender and his assistants. Mr. Callender gives the statistics of one hundred and ninety-nine operations performed by him at this great hospital since he became one of its surgeons, of which only six proved fatal, two being deaths from ovariotomy, and one each from nephrotomy, lithotomy, laryngitis, and cystic tumor. Of twenty-eight cases of compound fractures there was not a single mishap. Of fourteen amputations of the thigh, the average loss of which is about one in four, all recovered. In fourteen cases of amputation of the leg, in two of the arm, and in three of the forearm, none were fatal; making thus an aggregate of thirty-three cases of amputations, most of them of a serious character, without any deaths. Mr. Callender uses a drainage tube but only for the first twenty-four hours; cleanses the wound very scrupulously with a camel's-hair brush, and insures perfect rest with splints. He repudiates the so-called antiseptic system of treatment as wholly unnecessary.

outbreaks of erysipelas, pyæmia, or gangrene, the results of accidents, parturition, or surgical operations. Every patient should have allotted to him from fifteen hundred to two thousand cubic feet of air.[1]

To meet the contingencies arising in over-crowded hospitals during outbreaks of epidemic or zymotic diseases, as scarlatina, typhoid fever, measles, and small-pox, an English gentleman, Mr. Napper, lately suggested the employment of what are now known as movable fever hospitals, constructed upon the same principle as movable corrugated iron churches, intended to meet the spiritual wants of a sparsely settled community. Such a building can always be put up at short notice at little expense, and, as the object of its erection is a mere temporary one, there could be no difficulty in securing a suitable site.[2]

Convalescent hospitals, as they are termed, are now found in a number of the larger cities of Europe, establishments provided with all the usual home comforts, and surrounded by ample grounds, in which the patients, as soon as they have sufficiently recovered from their illness to bear the transportation, are sent for change of air and scene, exercise, and recreation. During my visit to London, two years ago, the beautiful grounds at Highgate, six miles from that city, owned by Sir Sidney Waterlow, and rendered famous as the residence of Nell Gwynne in the reign of Charles II., were dedicated by the Prince of Wales, in the presence of a large and fashionable assembly, as a convalescent hospital for St. Bartholomew's, of which the Prince is president. So far as my information extends there is no such institution on this side of the Atlantic. It is much to be wished that some of our wealthy and liberal-minded men, men whom God has blessed in their business relations, would turn their attention to the subject, and endow half

[1] Many of the military hospitals erected during our late war were models of what such institutions should be; spacious, thoroughly ventilated, and arranged upon the pavilion principle. Notwithstanding, however, all these, and a great many other advantages, not a few of them were infected with erysipelas, pyæmia, and gangrene. The naval hospital at Netty, stretched for upwards of a quarter of a mile along the British Channel, and the Herbot Hospital at Shooter's Hill, six miles from London, the former for the accommodation and treatment of sick, wounded, and disabled sailors, and the latter for sick, wounded, and crippled soldiers, are the most magnificent institutions of their kind in the world, reflecting, in their munificent outlays and the perfection of their internal arrangements, the highest credit upon the British nation, are both objectionable on account of their large size, and their consequent liability, from overcrowding, to occasional outbreaks of epidemic diseases. Each of these institutions has upwards of 600 beds.*

[2] The great advantage of iron is that it can be easily cleansed and purified by the use of paint, which speedily destroys any disease-germs with which it is brought into contact. In hot weather it is always easy to extemporize hospital tents for the accommodation of the sick in towns and cities, and of the wounded in time of war, thus affording them an abundance of fresh, wholesome air, instead of shutting them up in the confined, ill-ventilated wards of hospitals, which, under such circumstances, are literally pest-houses. These expedients were much resorted to, with the happiest effects, during our late war, on both sides of the line.

* To show that those statements are not based upon idle assumptions, I may here remark that of 2,089 cases of limb-amputations, collected by Sir James Y. Simpson, from eleven large metropolitan hospitals of Great Britain, 855 proved fatal, whereas of 2,098 limb-amputations in country practice, private and public, only 226 died, affording thus a difference in favor of the rural districts of 629 lives.

a dozen of such institutions, one of the great needs of every great city in the land.

In the summer of 1874, an establishment, entitled the "Seashore House for Invalid Children," was opened at Atlantic City through the exertion mainly of six gentlemen and ladies, who had the previous year secured a charter of incorporation from the legislature of the State of New Jersey. The institution, which is supported by private contributions, is supplied with a resident physician and good nurses, and has already been productive of great benefit. Such hospitals commend themselves to the good feelings and kindly sympathies of every humane and enlightened citizen, and should be erected at every seaside resort for the accommodation and treatment of children whose parents are unable to afford them proper care and assistance.

If hospitals are liable to become pest-houses, it is equally certain that private dwellings in the country, adorned with every luxury that taste and money can command, also occasionally serve as plague spots. It not unfrequently happens in such residences that the same wind which wafts to its occupants the fragrance of the rose and the honeysuckle, carries with it in the same breath the virus of the most deadly disease, due, in most instances, to defective sewerage, often little, if at all, suspected by the ill-fated inmates.[1]

The old houses in the dirty, narrow streets and alleys of our cities, are so many plague spots, which it would be a real godsend to burn to the ground. The great fire of London which, in the seventeenth century, within four days and nights, destroyed nearly the whole of its miserable and degraded districts, previously ravaged by the plague, was the greatest boon ever conferred upon that now mighty and majestic city. It completely eradicated that frightful disease, which has been so graphically portrayed by De Foe, and which, in six months in 1665, swept away nearly twenty thousand inhabitants, or one eighth of its population. No person can walk through Alaska Street in this city, or the Five Points in New York, without a sigh that civilized society should permit the existence of such degradation, such hot-beds of disease and vice; or without a silent prayer that God, in his infinite mercy, would visit the wretched hovels with consuming fire, the greatest scavenger and house-cleaner known to man. When we consider the many valuable lives that are lost by disease engendered by the foul air of such polluted and pestilential districts, it is evident that there is no economy in retaining such tenements, hardly fit as habitations for our inferior animals, but every reason, sanitary and moral, why they should be torn down, and others erected in their stead at the public expense. When this cannot be done, they should be frequently cleansed and disinfected. Now, what is true of such wretched dwellings, is hardly less true of the old and dirty stores, factories, workshops, school-houses,

[1] In 1833, Lexington, Kentucky, until then one of the most salubrious towns in the Union, as it has always been one of the most beautiful and charming, had its population decimated by Asiatic cholera from this cause; and a number of other towns in the west and southwest suffered equally severely.

hotels, and coffee-houses of every town and city in the world. To carry out these measures, useful alike in a sanitary and moral point of view, — for no people can be good or moral who do not habitually breathe pure air and enjoy the advantages of bodily cleanliness, — there should be salaried inspectors, who, under the supervision of a Board of Health, should at stated periods visit the more humble districts, and look after their sanitary condition, a part of their duty being to instruct the residents how to live, cook their food, ventilate their houses, dress their children, and, above all, how to keep themselves clean and tidy. These ideas are not Utopian, but founded upon common sense and the broad principles of hnmanity. There are some persons who are naturally clean and tidy under any circumstances, persons who have an inborn aversion to filth of every description, and who, however poor they may be, are always respectable, people in whose presence a gentleman instinctively takes off his hat; as there are other persons who are naturally unclean and untidy, who have no love for water and soap, whatever may be their worldly condition. With them dirt is soil always in the right place. How much these and a thousand other sanitary matters are neglected the world over, is as familiarly known as they are disgraceful and reprehensible; or, to put it in more just language, as they are criminal in the sight of God and of thinking man. We send missionaries into heathen countries, and spend thousands upon thousands of dollars annually in our efforts to civilize and Christianize our Indians; but we let the poor of our towns and cities wallow in their mire, contaminating the very air we breathe, and breeding disease and pestilence, which, in turn, cut off, often by an untimely death, many of our best citizens. We license coffee-houses to increase our revenues, and thus make drunkards and criminals, whom we afterwards punish with fine, imprisonment, and the hangman's rope. We boast of our civilization and our Christianity, and consider ourselves wise in our generation. Well may we exclaim, Where are our philanthropists, our legislators, our philosophers, our Christians? Where shall we find men, ready and determined, to stir up the public mind to devise measures for refining and elevating the wretched creatures, who, shut up in the narrow and filthy alleys and by-ways of our cities, are aliens from God and outcasts from society, often with hardly any of the natural attributes of human beings? I wish to God that some mighty Howard, armed with Gabriel's trumpet, would arise to teach us our duty; nay, not only teach, but compel us to perform it. Surely such apathy, such criminal indifference, must attract the notice of a beneficent Deity, and be visited with his sorest displeasure.

From the foregoing remarks the following conclusions may, I think, justly be deduced: —

1. That the maladies known, respectively, as erysipelas, pyæmia, septicæmia, hospital gangrene, and puerperal fever, all owe their existence to the same or similar disease-germs.

2. That these disease-germs, whatever their essential nature may be, possess an astonishing proliferating faculty, or power of multiplication and extension, especially apparent in overcrowded and ill-ventilated hospitals, asylums, prisons, ships, and similar establishments.

3. That these germs adhere with great tenacity to everything with which they are brought into contact, especially woollen articles; that, having once fastened themselves, they are destroyed with great difficulty; and, lastly, that they may readily be conveyed by the clothes, and even by the hands, from house to house, and patient to patient, by the medical attendants, nurses, and friends of the sick.

4. That, in dressing wounds, the greatest possible care should be taken to employ clean hands, instruments, and sponges, to avoid rude manipulation, to remove all extraneous matter, to effect close approximation, to guard against the retention of secretions, and to change the dressings the moment they become soiled.

5. That hospitals, however well constructed, especially during the prevalence of epidemics, are, as a rule, pest-houses, or breeders of disease-germs, and, therefore, under such circumstances, unfit as receptacles for sick, wounded, and lying-in persons.

6. That when a zymotic disease breaks out in a hospital immediate steps should be taken to place the inmates in tents in the open air, and to cleanse the wards with disinfectants, as chlorinated soda and permanganate of potassa, and, above all, by whitewashing and painting.

7. That the attendants upon the sick and wounded and upon lying-in women should make free use of disinfectants, keep their nails and hands perfectly clean, and never wear the same clothes in visiting their private patients that they wear in the performance of their hospital duties.

DOES SMALL-POX BECOME EPIDEMIC, OR IS IT SPREAD SOLELY BY ITS OWN CONTAGIOUS PROPERTY?

By EDWIN M. SNOW, M. D., *of Providence.*

A PAPER READ AT THE MEETING IN PHILADELPHIA, NOVEMBER 11, 1874.

THE phrase "epidemic small-pox" is common in writings upon medical and sanitary subjects. Whenever that disease is prevalent in any place, it is freely and generally spoken of as "epidemic," without, apparently, any very definite idea of what is meant by the word.

In addition to this common use of the term as applied to the prevalence of the disease in single cities or districts, we often hear of "the epidemic of small-pox that has prevailed in Europe and America during the last few years," thus asserting the existence not only of a local cause of small-pox in single places, but of a wide-spread cause, which extends at the same time over continents and oceans.

A writer in the "Sanitarian" for the present month uses language similar to this; but a more full and definite statement of what is meant by the phrase "epidemic small-pox," and of what is claimed in regard to it, is found in the following language from the fourth annual report of the Massachusetts State Board of Health, for the year 1872: —

"We are now in the midst of an epidemic influence of small-pox poison more virulent than has been known for many generations. The evidence is abundant to show that both in Europe and America there is, for some reason entirely unknown, a readiness in the human body to receive both the virus of small-pox and the virus of the vaccine disease, such as no one living has before seen.

"There are records of such epidemics before the great discovery of Jenner, and they were truly terrible, — destroying from one fifth to one third of all who were seized, and this comprised the whole population except those who had been previously attacked, or had been inoculated with the small-pox virus.

"The present epidemic is of such intensity that it is quite common for persons who have had small-pox in former years to now have it again. Such occurrences have been previously rare.

"Vaccinations, whether from the cow or from the human body, 'take' readily, and re-vaccinations prove abundantly the extraordinary susceptibility to the vaccine disease now prevailing, and *never before existing.*"

This is strong language, and describes vividly, though we think with some exaggeration, a condition of things that existed in Boston in the winter of 1872–73. A condition of things precisely similar existed in Philadelphia the winter previous, and has existed within a few years in Cincinnati, St. Louis, San Francisco, Washington, Pittsburg, Lowell, Worcester, and other cities in this country, and in London, Paris, Berlin, St. Peters-

burg, and other cities in Europe. We are all familiar with a similar condition of things, though not perhaps to the same degree. We have all seen times when the small-pox seemed to spread more rapidly and more easily than at other times, and when vaccinations seemed to "take" more readily. But does this condition of things, when it exists, depend upon any "epidemic influence of the small-pox poison"? In other words, Can small-pox become epidemic?

There are two points in the language I have quoted from the Massachusetts Report to which I wish to call attention. The *first* is the description of the state of things relating to small-pox which is ascribed to epidemic influence. *Second*, the claim that this "epidemic influence of small-pox poison" existed at the time named, the winter of 1872–73, not only throughout the State of Massachusetts, but even throughout all Europe and America.

Let us first examine the *second* portion of the subject. Though it is quite common to speak, as in the language quoted, of the epidemic of small-pox as wide-spread, and even covering both continents, I cannot see the reasons for the statement, nor acknowledge its truth. At the time named, it is undoubtedly true that there was a very general prevalence of small-pox in the city of Boston, such as is rarely seen in this country; but it is not true that at that time this condition of things existed generally in Europe or in America, no, not even in New England, nor even throughout the State of Massachusetts. In truth there was no marked prevalence of small-pox at that time, in this country, except in Boston and in a few Western cities. As this point is simply a question of fact, we may be permitted to quote a few facts which we find in the report from which the language is taken.

In the thirteen months, including the year 1872 and the first month of the year 1873, notwithstanding this so-called epidemic influence of small-pox, there were 120 towns in Massachusetts where not a single case of the disease, modified or unmodified, occurred; there were 50 towns in each of which a single case only occurred; and there were 111 towns in which the number of cases was five or less. No report was received from 25 small towns, which should undoubtedly be included with the towns in which no case occurred. We find, then, that of 342 towns in the State, 145 had not a single case of small-pox all through this terrible epidemic; 111 towns more had only five cases or less during the whole thirteen months, leaving only 86 of the whole 342 towns in the State in which there were more than five cases of small-pox or varioloid during that time. Certainly we cannot be expected to believe that an epidemic of small-pox, such as the report so vividly describes, existed in any town that had less than five cases of small-pox or varioloid in thirteen months.

We might show further, that this prevalence of small-pox, called a terrible epidemic, was not wide-spread nor general, even in Massachusetts, from the fact that, during the whole thirteen months, cities of considerable size, near and in constant communication with Boston, had only a very limited number of cases of the disease. Thus Lynn, with thirty thousand inhabitants, within ten miles of Boston, had only ninety-two cases in thirteen months; Lowell, twenty-five miles distant, with forty-two thousand inhabitants, had

only seventeen cases; Worcester, forty-two miles distant, with forty-five thousand people, had only twenty-four cases; Lawrence, twenty-five miles distant, with a population of thirty thousand, had only thirty-seven cases. In all these places the most of the cases that occurred were brought from Boston, and yet it is certain from the figures given, that no terrible epidemic influence existed in them.

I may add that the city of Providence, with nearly one hundred thousand inhabitants, forty-three miles from Boston, received during the same time, directly or indirectly, thirty-two cases of small-pox from that city, yet at no time were there the slightest indications of the so-called epidemic influence described in the report I have quoted. Looking abroad throughout the country, at that time, we see no evidence of any general and wide-spread epidemic of small-pox. There were a few cities with a considerable amount of the disease, and more places with single cases, or a few cases that could be directly traced to cities where the disease was prevalent. But the prevalence of small-pox was most certainly the marked exception, and not the general rule throughout the country. In far the largest portion of the country, the disease did not exist at all, and the unusual tendency of the disease to spread, and the remarkable facility of vaccine virus to take effect, as described in Boston, were almost unknown outside of that city. It was in Boston, at that time, as it was the year previous in Philadelphia, and as it has been at different times within ten years in a few other cities in this country and in Europe; but this wonderful prevalence of small-pox was not at that time, and has never in recent times, been general and wide-spread at the same moment of time, as would be necessary to constitute a true epidemic. It seems to me that we may safely conclude that the small-pox of the winter of 1872–73, did not possess the important characteristic of a true epidemic, of being wide-spread over the country at the same time. Let us now examine the condition of things that existed in Boston at that time, and which was ascribed in the Massachusetts Report to "the epidemic influence of small-pox poison." Was this an epidemic influence, or can it be explained more rationally in some other way? In other words, can small-pox become epidemic? We understand by an epidemic influence, some cause of disease which is wide-spread in its effects upon the people, which is independent of the ordinary or sporadic causes of disease, and which in itself, and by itself, has some power towards producing disease. Thus, for an illustration, when Asiatic cholera is truly epidemic, there is wide-spread over the country an influence which, of itself, tends to produce cholera, and which, in connection with local causes, does produce it, and *without which the cholera cannot exist even though all the local causes may be present.* Can we conceive of any such influence in connection with small-pox, any influence that can be correctly called epidemic? We all acknowledge small-pox to be contagious, and so far as we know, no case of the disease ever occurs at the present day without contagion, either direct or indirect. There may be causes like cold, which preserve the contagious virus and make it more active; and there may be causes like heat, which tend to weaken and destroy its power; but we can conceive of no cause that

27

will have the slightest tendency to produce a case of small-pox without contagion.

What then was the cause in the city of Boston, at the time named, that produced the state of things so vividly described in the extract we have given, when the small-pox seemed to fill the air, and to leap from house to house and to spread through the city, defying all attempts to trace the course of the contagion? In the city of Boston, during the year 1872, in the first four months of the year 1873, there were one thousand deaths from small-pox, the greatest prevalence being in the last three months of 1872. In unmodified cases of small-pox, one in four or five will die; but in cases of the modified disease the deaths are very rare. The result is that when small-pox is prevalent in a community where vaccination has been more or less attended to, there is usually a large number of cases of the modified disease, called varioloid. We may undoubtedly assume, as a low estimate, that in Boston at the time referred to, there were at least ten (10) cases of small-pox, modified or unmodified, for each death from the disease. It is probable that the number was still larger. This would give, at the lowest estimate, 10,000 cases of small-pox modified or unmodified in Boston during the period named. During the month of October, 1872, there were 103 deaths, which represented 1,030 cases of the disease; in November 165 deaths, and 1,650 cases; in December, 252 deaths, and 2,520 cases. Each case of the disease would last from two to six weeks or more. It seems probable from these facts, indeed we may consider it certain, that at one time, and for a considerable time, there were from 2,000 to 2,500 cases of the disease existing in Boston. Let us consider for a moment what a case of small-pox is. Each case, from its beginning to its close, is a living manufactory, in active operation, of virulent contagious poison. Every part of the body, yes, every pore of the body exhales this poison, every secretion of the body is saturated with it. It is manufactured in the skin at first in a liquid form, and then dries and is preserved in quantities sufficient, in each ordinary case of small-pox, to give the disease to millions of persons. All the clothing, bedding, and furniture of the sick chamber are infected with the poison, and give it forth into the atmosphere every time they are moved. More than this, every person sick with small-pox is breathing forth volumes of the contagion with every respiration. Thus the 600,000 cubic inches of atmospheric air that each patient inhales each day, come forth from his lungs changed into a virulent, contagious poison.

This is a single case of small-pox. Now, if thousands of these cases exist at the same time in a crowded city, and if the number continues full week after week, and month after month, it must certainly be sufficient to render the air of the city infected, at least in sections of it, so that persons might take the disease in passing the streets without seeing, or coming in direct contact with any case.

So, too, this concentration of small-pox poison would affect the whole people, giving the disease to all who had any remnant of susceptibility for it. Some persons who had previously had the small-pox, and some who had been vaccinated, would again be affected with the disease in its modified

form. This was precisely the condition of Boston for a considerable period in the fall of 1872 and the following winter. It seems to me possible, and indeed probable, that the amount of the disease in that city, at that time, was sufficient of itself to produce all the conditions which were ascribed to epidemic influence in the extract from the Report already presented. These conditions did not exist in the cities and towns named within a few miles of Boston, simply because there was not enough of the disease in those towns to produce them, and the fact that these conditions did not exist in those towns is, of itself, proof positive that there was no *true epidemic influence* of small-pox poison existing in the State at that time.

My conclusion is that the great prevalence of small-pox in Boston in 1872–73, as well as in Philadelphia the year previous, and in other cities, from time to time, had no connection with any true epidemic influence; but that the condition of things existing in those cities, and resembling an epidemic when the disease was at its height, was due solely to the great number of cases of the disease, existing at the same time in a crowded city.

It seems to me that the interests of sanitary science require us to repudiate the idea that the prevalence of small-pox may depend upon any mysterious influence called epidemic. The language itself is inconsistent and absurd. Small-pox is the result of a specific poison applied to the human body, through the skin, or through the lungs, and producing definite, specific effects. The vaccination disease is the result of a specific poison applied to the human body through the skin, and producing definite, specific effects. Both the vaccine disease and small-pox are frequently prevalent in our cities, to a greater or less extent, the vaccine disease much more so than the small-pox. May we not as well speak of the epidemic influence of the vaccine poison, as of the epidemic influence of the small-pox poison? We do not need the theory of "epidemic influence" to account for the prevalence of small-pox in any place; nor can we agree that such a theory is any valid excuse for such a prevalence of the disease. In this assembly, certainly, the doctrine is established that small-pox is propagated by contagion, and that we have in vaccination an almost absolutely perfect preventive of it. Whatever, then, may be our views in regard to epidemic influence, as sanitarians we must all agree, with reference to any, and to all cities and communities, that the prevalence, or the absence of small-pox will always be in exact ratio to the neglect or the observance of sanitary measures, including vaccination, by the authorities and by the people.

THE COST OF A GREAT EPIDEMIC TO A GREAT CITY, OR PENNY-WISDOM AND POUND-FOLLY.

By BENJAMIN LEE, A. M., M. D., *of Philadelphia.*

READ AT THE ANNUAL MEETING AT BALTIMORE, NOVEMBER 11, 1875.

So wide-spread and fatal an invasion of disease as the small-pox epidemic of 1871–72, should not be allowed to pass without its moral. To present this moral in such a form as to compel the attention, reach the understanding and insure the acquiescence of a public immersed in the cares of business, and giving little heed to scientific truth for its own sake, will be the aim of this paper. For if such an association as this is to accomplish its heaven-inspired mission, in a country where no reform can take place but as an outgrowth of public opinion, it must be by making its utterances instructive, not to its own members or even the medical profession alone, but to the intelligent masses who are the source of power.

Let us select the city of Philadelphia, which probably suffered most severely, as the subject of my calculation, and shall endeavor to present an honest contrast between what *was* and what *might have been:* what *was*, in the management of an epidemic purely in the interest of trade; what *might* have been, in its management in the interest of humanity and in the light of modern sanitary science, without fear and without favor. On one side of the balance-sheet, expenses actually incurred, disbursements actually made, and losses actually entailed; on the other, expenses, as they should have been incurred, disbursements as they ought to have been made, and losses which would have been entailed, had every recognized precaution been taken. The data for the first item of the first side of the account are easily obtained from the Reports of the Board of Health, for the years concerned, which furnish us a detailed statement of the entire pecuniary outlay for health purposes; from which we deduct a fair average annual outlay, and have remaining the expenses proper to the epidemic. The last item, namely, the losses entailed, involves some of the most intricate problems of political economy, and can be reached only by a careful process of calculation. It includes: Loss by diminution of traffic; loss by sickness; and loss by death and disability. To get at this last mentioned item we must endeavor to find an answer to the question "what is the money value of an average human life?" The other side of the account will embrace liberal estimates for greatly increased expenditures for all the precautionary measures which the authorities adopted, and for some which they did not adopt, and a determination of the degree in which the prevalence and mortality of the epidemic might have been abated, under the influence of these measures. We shall also derive much valuable assistance in arriving at a conclusion in

this matter from the very able and minute investigation of the subject presented in the Report of Dr. Wm. M. Welch, physician to the Municipal Hospital.

But before proceeding with the calculation, let me explain what I mean by the expression, "the management of an epidemic in the interest of trade." It must have been evident to every intelligent observer of the progress of this epidemic in the city referred to, who had any knowledge of its true extent, that the authorities made strenuous efforts to conceal its dimensions from the public. The whole aim of the daily press was to produce the impression, even when the disease was raging most violently, that it was present to but a very limited extent, — less than in neighboring cities; and their assertions to this effect they supported by quoting the authority of the Board of Health. No one can doubt that this course was pursued with the full concurrence of the board. Nor can any one gainsay that the motive for this concealment was the fear lest a publication of the true state of affairs throughout the country should deter strangers from visiting the city, and make persons at a distance suspicious of goods coming from the city, and thus seriously interfere with its trade and commerce. To suppose that it was done from sanitary motives, that is, under the belief that a panic would increase the susceptibility of the community to the disease, is to belittle the intelligence of the gentlemen composing that board. No one before me believed that any amount of ignorance or hardihood would prevent an unvaccinated person from taking the infection, whose system had absorbed the virus, or that a person thoroughly protected by vaccination could ever be frightened into having small-pox. The idea is simply puerile, and we are forced to fall back upon the assumption that the policy of concealment was dictated by the mercantile class and interest.[1]

[1] The Report of the Committee on Meteorology and Epidemics of the Philadelphia County Medical Society, for 1872, holds the following language in reference to this unfortunate policy: "In reviewing the history of this epidemic, your committee cannot shirk the responsibility of considering the manner in which the city authorities acquitted themselves of the grave duties which devolved upon them in the presence of so deadly a foe. We are forced to the conclusion that their operations were conducted from a mercantile rather than a humanitarian standpoint, with a view to husbanding trade rather than preserving life. So great was the dread of 'frightening away' business from the city that obvious precautions, such as were taken in other cities, were here neglected lest the impression should get abroad that the disease prevailed to an alarming extent. Beyond increasing the number of vaccine physicians, and enforcing the existing law in regard to the vaccination of children entering the public schools, — measures which, to prove effective, should have been adopted a year before when the first note of warning was sounded by this society, and which could be construed only as precautionary by those at a distance, — scarce anything was done to check the progress of the contagion. Your committee do not wish to be understood as charging the Board of Health or the City Councils with parsimony in their expenditures in the care of the sick. Hospital accommodations, which Dr. Welch considered ample, were provided for the plague-stricken, and nothing was neglected that could minister to their comfort or promote their recovery. But these officers seem to have considered it their first duty not so much to openly fight the infection as to conceal its existence. The daily journals, acting evidently under advice, either willfully suppressed facts or were not supplied with them, and treated the whole matter in a light and trifling spirit. It will scarcely be believed that, at a time when every hour that struck was the death-knell of one or more souls cut off by this single disease, — when all night long the streets rever-

First, then, to ascertain the amount expended by the Board of Health in combatting the epidemic. We find that in the year 1870 the disbursements for the Municipal Hospital, in which infectious diseases are treated, excluding special appropriations in view of the presence of an epidemic of relapsing fever, were $12,502.43. In the year 1873, which was so entirely free from epidemics that but forty-four patients were treated in the hospital, thirty-six of whom were suffering from various affections, they amounted to $12,143.73. We shall not err greatly, then, if we assume the average annual expenditure for the protection of the community from the ravages of infectious disease, excluding the item of street cleaning, as not directly connected with the present inquiry, to be $12,500.

During 1871, the first year of the epidemic under consideration, the expenses of this institution were $20,816.84, while additional appropriations to the amount of $25,098.92 were used in promoting vaccination, and disinfection, — in all, $45,915.76. During 1872 the expenditures for these combined purposes amounted to $35,549.08. The total expenditure during the continuance of the disease was therefore $81,464.84, from which, if we deduct an average expenditure of $25,000 for the two years, we shall have remaining the sum of $56,464.84 as the amount actually paid out of the city treasury in consequence of the presence of the epidemic.

Loss by Diminution of Traffic. — Having thus determined our first factor, we proceed to ascertain as nearly as may be what losses the city sustained by diminution of traffic. I know of no more trustworthy indication of the condition of a city's trade than the amount of travel on the thoroughfares leading to it, and the number of persons moving on its streets, when ob-

berated to the rumble of vehicles of every description, surreptitiously bearing away the unattended bodies of its victims, alike from the mansion and the hovel, to graves unhallowed by prayer or tear, — that at such a time, one of our leading papers could come out with the unblushing statement that the disease was not then and had not been, 'in the true sense of the term,' epidemic in the city, and could father the astounding assertion upon the Board of Health."

Referring to certain measures advised by the board toward the close of the epidemic, the same report says: "Your committee cannot but feel that had these excellent suggestions been urged upon the City Councils at the commencement of the epidemic, when it first assumed threatening proportions, and had public opinion, if necessary, been stimulated by a frank *exposé* of the true condition of affairs, all necessary powers would have been conferred upon the board. As it was, the most shameful license prevailed. Persons were continually seen on the streets, and met in public conveyances, whose faces were still desquamating. Clerks returned to their positions in stores, to convey to their customers the lethal poison in the goods they handled, and in one case, at least, a street-car conductor resumed the discharge of his duties in a pestiferous condition. The cars themselves were knee-deep in filthy, foul-smelling hay. Shops were allowed to pursue their traffic, while, in the same house, sometimes even in an adjoining apartment, patients were prostrated with the infection. Undoubtedly a most efficient agent in perpetuating the vitiated condition of the atmosphere was to be found in the retention in rooms and houses in which cases had occurred, of clothing, carpets, bedding, etc., which contained the seeds of disease. . . . . No alternative was offered to those whose household goods, often their entire wealth, had been exposed, but to keep them in their foulness, adopting in rare cases such ineffective methods of disinfection in their own homes as their limited knowledge might suggest, or to send them to the Municipal Hospital, to be confiscated or burned. It is not difficult to determine which course was more frequently followed."

served for a considerable period of time, such as no mere transient cause would affect. That these numbers were noticeably diminished during the latter part of the epidemic, when the public mind had become thoroughly alive to the extent of the danger, was evident. In order to obtain trustworthy data for estimating the amount of this diminution, I addressed, in the spring of 1873, a brief note to the superintendents of each of the leading lines of railroad converging in the city, and of the city passenger railways, inquiring to what extent travel and traffic over their respective roads had been interfered with by the epidemic of the two previous years. I received courteous and more or less explicit answers from the officers of three railroads, the Philadelphia, Wilmington, and Baltimore, the Philadelphia and Baltimore Central, and the Philadelphia and Reading, and of seven passenger railways. The following are the more important of the estimates and figures thus obtained.

"The whole revenue of the Philadelphia, Wilmington, and Baltimore Railroad Company [1] from both travel and traffic for the last quarter of the year 1872, showed a net increase of about thirteen per cent. over that of a corresponding period of the year 1871." During the latter period, the epidemic, it will be remembered, was approaching its height; while by the commencement of the former it had ceased to exist, and public confidence was fully reëstablished. If we allow six per cent. for natural increase of business, we shall have a balance of seven per cent. as representing the proportion by which the revenues of this company were diminished, by the dread of contagion on the part of those living along its various lines of communication in Southern Pennsylvania, Delaware, and Maryland.

The "Reading" estimated its "decrease in passenger travel at about five to six per cent. of all those who would have come to Philadelphia from various points in its territory during the prevalence of the epidemic," and its "decrease in *outward* freight business at three or four per cent." That these estimates of the decrease of travel over these two great feeders are not exaggerated, but probably fall below the actual fact, we may reasonably conclude, from the following account of the experience of the Thirteenth and Fifteenth Streets Passenger Railway Company, which derives a considerable portion of its patronage from these roads. This enters so much into detail, and its figures are so suggestive and at the same time so evidently the result of careful investigation, that I venture to give it in full.[2]

[1] Mr. Geo. A. Dadman, the General Ticket Agent of the Philadelphia, Wilmington, and Baltimore Railroad Company, informs me that the total number of passengers carried by his company during the year ending October 31, 1870, was 1,669,171, of which number 553,950 came to Philadelphia. This, it will be observed, is, as nearly as may be, one third of the entire travel on the road, a very much larger proportion than I have supposed.

[2] DEAR SIR, — . . . . "During the month of December, 1871, there was an actual decrease of ten thousand seven hundred and thirty-six passengers from the same month of the preceding year. In January, 1872, there was a decrease of eighteen thousand six hundred, in February four thousand eight hundred, and in March twenty-two thousand, making for the four months a decrease in the number of passengers carried during the corresponding months of the previous year of fifty-six thousand one hundred and thirty-six. To this number must be added the natural increase of the road, which would fully equal the decrease or the four months already mentioned, which of course would just double the number of

The "Baltimore Central Railroad," whose business is exclusively local, and not very extensive, supposes its loss "in money to have been about $10,000, on account of the epidemic." I received no response from the Pennsylvania Railroad Company, which would probably have given the most interesting result of any, draining as it does an immense rural region, much of it very populous. Here again, however, the passenger railway which receives its incoming passengers, affords us valuable aid in coming to a conclusion with regard to travel at least. Mr. English, the general superintendent of the West Philadelphia Passenger Railroad Company, informed me that during the four months of the winter when the disease prevailed, the receipts of his road, which conveys pretty much all the passengers of the Pennsylvania Railroad, probably fell off fifteen per cent. As the estimates of the other street railways vary from five to ten per cent., we are justified in concluding that the excess in this particular case was owing to the failure of the greater artery of trade to supply its usual quota of travelers. We shall undoubtedly be rather below than above the mark if we place the diminution of ingress into the city for a period of six months from October, 1871, to April, 1872, at six per cent. and of outgoing trade at four per cent. We have here three elements of loss. First, the direct loss to the railroad companies; second, the loss to retail dealers and hotel keepers and thirdly the loss to wholesale merchants. If we suppose one tenth of the stock of the railroad companies to be held by citizens of Philadelphia, both in their private and corporate capacity, we shall arrive at the following definite result in regard to this item. The receipts of all the railroad companies centering on Philadelphia were for the year 1870, $36,809,715. If we add to this six per cent. for natural increase we should have had for the year following a total of $39,018,298. Halving this, we get $19,509,149 as the probable revenue for six months. Four and a half per cent. of this gives us $877,911.50, as the loss of the combined companies, and one tenth of this again, $87,791.15, as the loss sustained by the citizens and city, from their direct interest in the roads.

The receipts of the city passenger railways for 1870, were $3,332,424. Adding nine per cent. for natural increase in eighteen months their receipts for the year ending April 1, 1872, should have been $3,632,332, and for six months $1,816,166. The average loss estimated by the officers of these companies was eight per cent., which would yield an aggregate loss of $145,293, two thirds of which, or $96,862, I estimate to have been borne by Philadelphia itself.

Loss to Hotel-keepers. — One day is probably not too long a sojourn in the

passengers, making a total of one hundred and twelve thousand two hundred and seventy-two persons who did not ride in our line of cars during the months of December, January, February, and March, 1871–72, on account of the small-pox which prevailed at that time.

"From the record of deaths in this office caused by this disease, I find that the greatest number occurred during the month of December, 1871, numbering 861. In January there were 832 deaths, in February 457, and in March 536; and yet, during the month of March we seem to have suffered most in our business. This was owing, no doubt, to the fact that the disease had spread more generally, although the deaths were not as many as during any of the preceding months, with the single exception of February."

city with which to credit each incoming passenger. The entire number of passengers carried by all the roads which enter the city in 1870 was considerably over 15,000,000. Add six per cent. per annum for natural increase and we have 16,350,000. One half of this is 8,175,000, which represents the probable travel for six months. When I say that one fifth of this entire number were carried by a suburban railroad whose terminus is not twenty miles out of the city, it will be allowed that one fourth of the number is a moderate estimate of those going to and from Philadelphia, the metropolis of the State and centre of its business interests. This we must divide by two again as showing the travel in one direction only. We shall then have 1,021,875, as the number of incoming passengers for six months. Six per cent. of this number gives the estimated diminution in the number of those visiting the city, namely, 61,312. A fair average charge for transient board and lodging, taking the large and small hotels and boarding-houses through, is three dollars. We have, therefore, $183,936, as the amount of money which failed to be deposited in the hands of this portion of the community, from whom it would have passed immediately into those of the public.

Loss to Retailers. — Each of these visitors, moreover, would have probably expended, at the very lowest calculation, five dollars on articles of dress, convenience, and house furniture, which, received by the retail dealers, would also have found its way very quickly into the general circulation. This item would amount to $306,560.

Loss to Merchants and Manufacturers. — The great loss, however, in the way of traffic fell upon the manufacturers and wholesale dealers. This we can only get at by deducting from the entire production of the city the probable amount of products consumed in the city, and considering the balance as equivalent to outgoing freight upon the railroads, which we have seen fell short by at least four per cent. of what it might justly have been expected to be. The production of all the manufacturing operations of Philadelphia amounted in 1870 to $335,000,000. This is just about double the production of the year 1860. The rate of increment is therefore ten per cent. per annum. This enables us to add fifteen per cent. for the year ending April 1, 1872, which would give the sum of $385,250,000, one half of which, or $192,625,000, is the production for six months. From this we must in justice deduct steamships, locomotives, iron bridges, and similar articles of great bulk, the manufacture and sale of which would not be interfered with and which could not enter into the category of freight, and iron and glass ware generally, as not liable to infection. Allowing $44,866,000 for such branches of industry, we have remaining $147,759,000. To make a very liberal estimate, we will suppose that fifteen per cent. of its products is consumed in the city itself, amounting to $28,893,750. Deducting this amount also from the total production, we have a balance of $118,865,250, representing the proper exports of the city, as distinct from goods merely transferred here but manufactured elsewhere. Four per cent. of this amounts to $4,754,000, a loss which, falling directly upon the large employers, makes itself felt at once among their employees, and so with great directness upon the community at large, a more severe check to the immediate growth of the wealth of the city than could be given in any other way.

The extreme moderation of this estimate will appear from the following statement taken from the Report of the Joint Special Committee of the City Councils of Philadelphia, for the year 1872.[1]

Our losses by diminished travel and traffic, then, are as follows: —

Revenues of Railroads		$87,791.15
"	City Passenger Railway	96,862.00
Receipts of Hotels		183,936.00
"	Retail Dealers	306,560.00
"	Wholesale Dealers and Manufacturers	4,754,000.00
	Total loss	$5,429,149.15

Loss by Sickness. — The first point to be determined here is the number of the sick. The second, the average duration of the sickness. The third, the cost of the care of the individual case. The fourth, the average daily wages, or value of productive labor. The number of cases reported was 15,629. But this evidently falls far below the mark, as it would make the percentage of deaths in the city at large very nearly equal the percentage in the Municipal Hospital, 28.078 per cent. as compared with 31.251 per cent., or one death in 3.561 cases as compared with one death in 3.199 cases. Now, when we consider the class of population from which hospital patients are for the most part drawn,[2] and the fact that usually the most severe cases are those which are removed to the hospital, we shall inevitably be led to the conclusion that there should be a much greater disparity of mortality between these two conditions.[3] A general review of the history of the subject has led observers to consider one in six as about the average mortality.[4] Assuming, then, a decidedly higher rate than we should be at liberty to from the citations quoted, I will suppose that for every death four and a half cases of sickness took place. This would give us a total of 20,065 cases.

[1] "The value of goods passing over these roads can only be estimated, but those that go to distant markets for consumption cannot be less than several hundreds of millions annually in each direction."

[2] Dr. Welch says, in his report for 1872: "A large proportion of the patients were from among the lower order of society, with constitutions exhausted and perverted by intemperance, and many of these were not received until all hope of recovery had passed. A no less number than one hundred and twenty-eight (128) cases died within forty-eight (48) hours after their admission. Indeed, a few of the patients whose names have been entered on the Record Book, never breathed within the hospital walls; some of these were found dead in their homes, and their bodies were brought here simply for burial, while a few others died in the ambulance, on the way to the hospital."

[3] Dr. Welch shows that the average mortality for the hospital itself, going back over a period of thirty-one years, is 17.31 per cent., or one death in every 5.79 cases. The mortality of the London Small-pox Hospitals during the recent epidemic was 18.65 per cent., or one death to every 5.36 cases. The general mortality in the Municipal Hospital of Leipzic, during the same invasion, was but 14.7 per cent., or one in 6.8 cases.

[4] In this connection the Report of the Board of Health for 1872 says: "It is not supposed that all of the cases of sickness have been reported. Many light attacks of varioloid have, doubtless, run their course without the services of a physician being sought, and other cases of the disease under medical attendance have failed to be registered, in some instances through the solicitation of the friends of the patient, who feared interference. . . . . Could a proper allowance be made for all these cases, the percentage of deaths to the amount of sickness would be considerably reduced."

Deducting the 4,464 deaths, we have within a unit of 15,600 cases which terminated in recovery.[1] That this estimate of the entire number of cases is far below the actual fact is sufficiently evident from the statement of Dr. Turnbull in the Report on Meteorology and Epidemics of the Philadelphia County Medical Society for 1871, that "up to the time of the preparation of that report early in 1872, the Board of Health considered that there had been at least 25,000 cases of the disease."

The running expenses of the Municipal Hospital for the year 1872, independent of all salaries were about $15,000. The number of patients treated was about 1,500. These totals are sufficiently accurate to serve as a perfectly fair basis for computation. Of these 1,500 cases, four hundred died. The average sickness of these we have stated at twelve days. This gives us 4,800 days of hospital treatment for the fatal cases.

To each of the 1,100 cases of recovery, we may assign an average stay in the hospital of twenty-six days, which will give us a total of 28,600 days.[2] Adding these two products together we have 33,400 days of hospital care at an expense of $15,000, as nearly as may be forty-five (45) cents per diem, for board, medicines, and fuel. If we reduce the London estimate (see note) of per diem expense to our currency and add fifteen per cent. for the gold premium, we shall have thirty-eight (38) cents as the daily cost of each individual. This makes our own expenditure seven (7) cents per diem, per

[1] The average of fatal cases in hospital may safely be taken as the average of all the fatal cases, namely, twelve days. He says . . . . "one hundred cases of varioloid, taken in the order in which they appear on the record book, were under treatment 1617 days, counting from the first appearance of the eruption until they were considered fit to be discharged from the hospital. That will make an average of $16\frac{17}{100}$ days per patient. . . . . Of one hundred cases (unvaccinated) of variola, taken in the same order, I find that the number of days they were under treatment from the first appearance of the eruption until discharged, amounts to 4,233 — making an average per patient of $42\frac{33}{100}$ days.

"Cases of variola continue to be infectious much longer after recovery than varioloid, since the crust and scales adhere to them for a much longer time."

Taking the 1,061 cases of recovery from varioloid which occurred at the Municipal Hospital, and multiplying them by $16\frac{17}{100}$ we have 17,156 days; and taking the 573 cases of recovery from variola and multiplying them by $42\frac{33}{100}$ we have 24,255 days, making a total of 41,411 days which divided by the sum of the cases, gives $25\frac{1}{3}$ days to each case, which, it will be seen, is nearly identical with my own estimate.

[2] The report of a Committee of the Managers of the Metropolitan Asylum district with statistics as to the cases of small-pox treated in their respective hospitals during the small-pox epidemic of 1870–71–72, refers to the pecuniary side of the question in the following important paragraph: "Next, as to the additional cost imposed upon the rate payers in consequence of non-vaccination and the imperfect manner in which vaccination is often performed. The average duration of treatment of well-vaccinated cases (of varioloid) is about twenty-one days. Up to the 30th of March last, 14,400 cases were treated, of which 2,700 died, and 11,700 remained under treatment until complete recovery. If all of these had been properly vaccinated, the duration of their stay in hospital should have been about 245,400 days; but the actual duration of their stay in hospital charged to the parishes and unions for these 11,700 cases (allowance having been made for the 2,700 deaths), has been 378,700 or 133,300 days more than would have been the case had all been well-vaccinated — which as the average cost per patient for maintenance has been 1*s.* $4\frac{3}{4}$*d.* per day, represents an extra charge of upwards of £9,300 for maintenance alone, exclusive of the proportionate additional expenditure incurred for the salaries and maintenance of officers and the other establishment charges of the hospitals."

patient, more than that of the London hospitals. In point of fact remembering how much more generous our dietary is, the excess is probably still greater, and if we take the city through, averaging all classes, fifty (50) cents per day for every case of variola and varioloid from invasion to death or convalescence will be far within the limit.

We have then, deducting the hospital cases, 3,721 deaths, averaging twelve days of care, and 13,966 recoveries averaging twenty-six days. These give us respectively 44,642 and 363,116 days, together 407,758 days, which at fifty cents a day represent an expense of $203,879, incurred in the care of the sick in their own homes.

Loss by diminished Production. — In estimating the loss by diminished labor as expressed in day's wages, the age of patients must of course be taken into account. It is probably safe to say that up to the fifteenth year there is little productive labor performed. There should be none. Now we find that of 2,377 cases admitted to the hospital, 326 were below this age, or 137 per thousand. Applying this proportion to the 20,065 cases which we have assumed to have existed, we have 2,748 non-producers, leaving 17,317 who may fairly be supposed to have added to the wealth of the community. Of this number, however, sixteen were above the age of seventy and cannot be supposed to have been active contributors. We may therefore call it 17,300. Of these 2,067 deaths occurred. The days lost by those who succumbed will therefore be twelve times this latter number, or 24,804. Deducting the fatal cases from the whole number we have 15,233 whichterminated in recovery after an average period of enforced idleness of twenty-six days. (It should of course have been longer to insure safety from contagion.) Thus we have 396,058 lost days, which, added to the former gives a total of 420,862 days' work lost by reason of sickness. But this is the loss of those actually sick alone. It must be remembered that each case of sickness necessitated the loss of time on the part of one or more care-takers, while a conscientious dread of carrying contagion often restrained others from going to their places of business who were not essential to the care of the sick. This element of loss pertained to all cases young as well as old. We shall be justified in allowing a loss on this account of at least two thirds of the direct loss by sickness, deducting the hospital cases. The whole number of days of sickness we have estimated at 459,168, of which 33,400 were credited to the hospital — leaving 425,768 for the city at large, two thirds of which is 283,848. We will assume this labor to have been that of women altogether, as it was for the most part. Added to the number already obtained, it produces a total of days' labor lost 704,710. The proportion of males to females affected by the disease is shown by the reports both of Dr. Welch and of the health officer to be considerably above three to two. But allowing it to be in this ratio we shall have our days distributed between 275,521 males and 183,647 females, to which latter must be added the 283,848 days of care-takers, making 467,495 female days' work.

Value of a Day's Labor. — Dr. R. Brudenell Carter, in an article on "Waste of Life by Preventable Disease," fixes an average week's wages in London at, to say the least, £1, or $5.75 of our currency, nearly a dollar a

day. We know perfectly well that the average wages in this country is considerably in advance of that in England. Dr. W. E. Boardman, of Boston, in an article entitled the "Value of Health to the State," published in the "Report of the State Board of Health of Massachusetts for 1875," shows, on the basis of four classes of occupation, as tabulated in the "Fifth Annual Report of the Bureau of Statistics of Labor of Massachusetts" (many of the operatives being below the limit which we have adopted of fifteen years of age, the entire number employed being 154,167), that $7.40 represents the average amount received weekly by each individual, and adds that this furnishes a low estimate of the average receipts of the entire working population. This would give something over $1.23, as a day's wages.[1] This would give, allowing as before, an average of three hundred working days to the year, a daily amount of somewhat over $1.40. The revised census of 1870, published by order of the City Councils, shows the total amount of wages paid in Philadelphia and its immediate vicinity, to have been $68,647,874, which was divided among 100,661 adult males, 40,760 adult females, and 11,129 youth, most of whom, under the age of fifteen, were females; and if these young girls earned half a dollar a day, we shall have their wages amounting to $1,269,350 for the year, which deducted from the total amount leaves $67,378,524 to be divided among 141,421 operatives, rather more than $475 apiece, or $1.58 per diem.[2]

We shall certainly be entirely within limits, then, if we assume each individual's productive capacity above the age of fifteen, to be $1.50 per diem. Estimating, as we have seen we may, the producing youth at one thirteenth of the number of adult producers, we shall have 1,332 individuals, of whom one fourth lost twelve days, making 4,000 days, and three fourths twenty-six days, making 26,000, in all 30,000 days, which at fifty cents a day would produce $15,000. The number of days lost by the full producers, including both deaths and removals, we have demonstrated to have been 704,710, which at $1.50 per day, gives us $1,057,065. Add to this the wages of the youth, and we have a total loss of productive labor of $1,072,065. But we have not yet exhausted the sources of loss to the city's productiveness.

The records of the Municipal Hospital show that by far the larger number of cases of variola occurs just at maturity, between the ages of fifteen and twenty-five, an age which would leave the greater part of the productive life still to be lived. We may then assume one half of the disabled as a fair average of those who would be a tax upon society during their expecta-

[1] Mr. David A. Wells writes me on this subject as follows: "I have not at hand the census data showing the average wages paid for labor in different branches of employment in the United States in 1870; but in Massachusetts, where the average wages are highest, the average annual amount paid to each person engaged in manufacturing industry, was $422.42. I think you might safely assume this as a rate fairly representing the average wages of persons engaged in manufacturing occupations in the city of Philadelphia."

[2] Dr. A. G. Field, of Iowa, in an article on the "Importance of Sanitary Legislation," read before the Medical Society of that State at its last meeting, places the average value of a human life, "for what it produces," at twelve hundred dollars, and an average day's work at two dollars.

tion of life. We then have 4,000 times $5,000 = $20,000,000, one half of which is $10,000,000, as the cost of the maintenance of the disabled in this terrible fight, combined with the loss of their productiveness.

Loss by Death. — Let us now attempt to determine the value of the 4,464 lives which were sacrificed. The average value of a sound horse is not far from $250. In former days an able-bodied negro was valued at from $1,000 to $1,500. Young and old, taken together, were considered to represent a property average of at least $500; and the young being held at about $10 per pound, the newly-born infant, if well-formed, healthy, and likely to live, was deemed an addition to his master's wealth of not less than $100. Now, all economists agree in considering free labor as more valuable than slave labor, in the same capacity. And it must be borne in mind that the slave for whom this price was paid, was, as a rule, simply a farm hand, "with no particular skill beyond that necessarily acquired in the rude experience of farm labor anywhere," whereas much of our city labor is skilled labor of the very highest order. Taking into consideration, then, these two facts, together with the general rise in values and depreciation of currency, we shall be extremely moderate if we value the average adult above the age of twenty at $2,000; the youth between ten and twenty at $1,000; and the child, from birth to the age of ten, at $500.[1]

An additional item of expense to be considered is that of the final disposition of the victims of the epidemic.[2] Dr. Brudenell Carter, already

[1] Taking $450 per annum as a fair standard of productiveness, and allowing the individual an expectation of twenty years, we shall raise his value to $9,000.

This closely corresponds with the estimate of a Western journal of acknowledged ability, which says, in speaking of the advantages of immigration in connection with increased railroad facilities: "It may be safely estimated that the value of each immigrant would average $10,000 as an addition to the wealth of the country. This estimate includes the money and valuables brought over, the value of their labor, the effect of increased population upon real estate values, the extending of the basis of taxation, and the augmentation of our power and splendor as a people."

Now, it is not to be supposed that, apart from the "money and valuables" which he brings with him, the foreigner is of any more value than the native, if, indeed, of as much. If we, then, allow $1,000 as the amount of valuables which each immigrant brings, an estimate greatly above the fact, we shall have $9,000 remaining as the intrinsic worth of the man to the country. This is a very much higher valuation, however, than I have seen ventured on elsewhere. Mr. Wells, as we have seen, regards the individual at maturity as representing an investment of $1,500, which, of course, would place his actual productive value at a considerably higher figure. Now, we find the number of deaths between the ages of twenty and sixty-five to have been 1,644, which, multiplied by $2,000, gives us $3,288,000; between ten and twenty years 670, which, multiplied by $1,000, gives us $670,000; and from birth up to ten years 2,110, which, multiplied by $500, gives us $1,055,000. The one hundred deaths which took place above the age of sixty-five we will leave out of the calculation, although many of them may have been producers, with an expectation of at least ten years of valuable life. The sum of these three amounts is $5,013,000, as the least probable loss by death.

[2] With a pertinacity which is most unfortunate in its suggestiveness, the Board of Health always sees fit to associate "*medicines, coffins, and burial expenses*" as one item of expenditure in its financial budget. It is not easy, therefore, to assign the latter their proper quota, but we may suppose, from the line of treatment adopted by the physician in charge that the drug bill was not a large one, and that four fifths of this amount, or about, $2,100, went for funerals.

quoted, estimates the average cost of an interment at £2, about $11.50 of our money. I know from my own experience that it is no uncommon thing for the funeral of a common Irish domestic to cost from $80 to $100 in Philadelphia. Twenty dollars would probably be a moderate allowance for each, if we set aside those who died in hospital as having been buried at the city's expense. We shall then have 3,721 interments at $20 each, amounting to $74,420.

The first side of our balance-sheet will therefore foot up as follows: —

Losses by diminished travel and traffic:	
By railroads	$87,791.15
" city passenger railways	96,862.00
To hotel-keepers	183,936.00
" retail dealers	306,560.00
" merchants and manufacturers	4,754,000.00
Losses by sickness and death:	
Moneys disbursed by Board of Health	56,464.84
Expenses incurred in care of sick	203,879.00
Loss by sickness, direct and indirect	1,072,065.00
" " disability	10,000,000.00
" " death	5,013,000.00
Expenses of burial	74,420.00
Total loss	$21,848,977.99

Thus much for the historical division of our subject, the losses actually incurred. In introducing the consideration of the second, I need scarcely go beyond the admirable reports of Dr. Welch,[1] already alluded to, and of the vaccine physicians of Philadelphia, to show from their experience in this very epidemic, how completely its invasion might have been repelled, thus dispelling all dread, preventing all panic, and allowing intercourse and trade to flow unchecked through their accustomed channels.

Let us suppose that extra vaccine physicians had been appointed from

[1] After a careful analysis of all the cases which fell under his care in 1871 in respect to vaccinal and variolous history, vaccinal marks, severity of attack, and result, Dr. Welch considers himself entitled to conclude that, of the 1,879 deaths caused by this disease during the last few months of that year, the immense proportion of 1,509 might have been prevented by thorough vaccination and revaccination. Applying the same reasoning, to the mortality from variola in 1872, which reached the startling figure of 2,585, we should have the number of preventable deaths during the first four months of this year about 2,070, which added to those of the previous year gives a grand total, for a period covering little over seven months, of 3,579 deaths, which might have been averted by the careful and systematic employment of means with the value of which we were thoroughly acquainted. This would have left an actual mortality of 885 for the two years, of which the larger proportion, 515, would have belonged to the second year, — a mortality which would not have been sufficient to create any wide-spread consternation. "This estimate," he adds, however, "is yet wide of the mark, for we have seen that, by thorough vaccination in infancy, 2,924 of these cases would not have contracted variola." Who can estimate the number that contracted the disease from these? How far below the mark the doctor's estimate is, is sufficiently shown by the following fact taken from his report for 1872: —

"Among 2,377 cases of small-pox admitted during the epidemic, only thirty-six are said to have been revaccinated, of which four died. But by subjecting these cases to careful analysis, we find that only nineteen of them had been recently revaccinated, ... and only three were able to show good cicatrices." *Of these three, none died.*

the beginning of the year 1871, that their number had been double what it was, and their salaries increased by one half, in order to enable them to devote more time and attention to the results of the operation, and thus insure complete protection in every case. We should then have the salaries of twenty-seven vaccine physicians for eighteen months, up to the expiration of the epidemic, at $1,000 per annum each, $40,500. Let us suppose a vaccine bureau, the principal details of which would be attended to by the staff of vaccinators, and the expenses of which would therefore be but slight, say $500 per annum, with a chief at a salary of $2,000 per annum, whose duty it should also be to superintend the Vaccine Farm, so far as the selection of animals and oversight of the operations went. The cost of carrying on this farm is not very easy to estimate.

A building for disinfecting purposes could be erected on the grounds of the Municipal Hospital, and would be an inexpensive wooden structure. The principal expenses connected with it would be full service and transportation. If we allow $2,000 for the erection and equipment of the structure, $750 per annum for the wages of three employees, a ton of coal a week for the entire year $250, and transportation $1,000, we shall have $4,000 as the necessary outlay for this most essential and valuable addition to our available force and *material* for the two years, inasmuch as it would be an actual expense only during the prevalence of infection. A corps of dwelling disinfectors, who should visit every house in which a case of the disease was reported, and subject the apartments liable to have been infected to thorough purification, would have added, perhaps, as much more. For "general expenses of the Sanitary Committee," such as printing, stationery, and traveling expenses, in diffusing information and arousing public and legislative interest in the subject of vaccination, let us increase the appropriation for the first year from $300 to $1,500. In the second year it would probably have been unnecessary to increase it at all. Let us see what these various items will amount to in the aggregate: —

Salaries of Vaccine Physicians	$40,500
Salary of Chief of Vaccine Bureau	4,000
Expenses of Vaccine Bureau	1,000
Lease of Vaccine Farm	2,000
Fitting up Hospital of Farm	500
Cost of running Hospital of Farm	6,000
Erection of Disinfecting Station	2,000
Expenses of Disinfecting Station	2,000
Corps of Dwelling Disinfectors	4,000
Expenses of Sanitary Committee	1,800
	$63,800

To counterbalance this increased expenditure for *prevention*, we shall have the right to claim an immense reduction in that for *cure*, and we shall find in our summing up that the old adage, in its proportion of ounce to pound, is by no means outside of the mark.

The extent to which we have reason to hope that revaccination would still farther reduce susceptibility is difficult to estimate — still more difficult

to over estimate. Out of 6,221 cases admitted into the Hampstead Hospital, there were but three in which there was any satisfactory evidence of revaccination. As there had been a perfect mania for vaccination in London and elsewhere it is evident that a large proportion of the inhabitants of Hampstead must have submitted to the operation. Among 240,000 public school children in New York among whom revaccination had been carefully enforced, scarcely a single case occurred. If we allow the very moderate estimate of five per cent. additional protection to life, and ten per cent. prevention of sickness for this precaution, we shall raise our percentage of preventable deaths to ninety-five and of preventable cases to eighty-five.

Taking the city at large we should have our 3,721 deaths reduced to ninety-three and our whole number of cases to 2,006, leaving 1,913 recoveries. These would give us respectively 1,116 and 32,096 days, together 33,212 days, representing an expense of $16,606. The loss by sickness would be diminished by nine tenths, leaving $107,206.25. That by disability would be reduced to $425,000. and that by death to $125,335. Summing up the account, an additional expenditure by the city authorities, of about $20,000, for purposes of prevention, made sufficiently in advance, and with such publicity as to make the public fully aware of the impending danger, accompanied by appropriate sanitary legislation, and a hearty co-operation on the part of its inhabitants, would have resulted in a saving to the city of Philadelphia of the sum of $24,720,718.99.

An Exhibit of what the Epidemic cost under a Policy of Concealment.

Amounts actually disbursed by Board of Health	$56,464.84
Loss by diminished travel and traffic: —	
(*a*) to Railroads	87,791.15
(*a*) to City Passenger Railways	96,862
(*b*) to Hotel Keepers	183,936
(*c*) to Retailers	306,560
(*d*) to Merchants and Manufacturers	4,754,000
Loss by sickness, death, and disability: —	
(*a*) Expense of care of sick	203,879
(*b*) Loss of time in sickness	1,072,065
(*c*) Loss of time by death	5,013,000
(*d*) Loss of time by disability	10,000,000
(*e*) Expense of premature burial	74,420
	$21,848,977.99

An Exhibit of what would have been the Result of the Policy of Prevention.

Increased expenditures of Board of Health: —	
(*a*) Twenty-seven vaccine physicians (18 months)	$40,500
(*b*) Expenses of Vaccine Bureau	1,000
(*c*) Salary of Chief of Vaccine Bureau	4,000
(*d*) Lease of vaccine farm	2,000
(*e*) Fitting up hospitals for vaccinifers	500
(*f*) Expenses of vaccine farm	6,000
(*g*) Disinfecting station	4,000
(*h*) Corps of dwelling disinfectors	4,000
(*i*) Diffusing information	1,800
(*k*) Expenses of municipal hospital (reduced)	1,856
(*l*) Loss by sickness, death, and disability	674,141
(*m*) Expense in care of sick	16,601
(*n*) Expense of burial	1,860
(*o*) Loss by diminished travel and traffic	00,000
Balance to credit of sanitation	**$21,090,713.99**
	$21,848,977.99

SANITARY AND ECONOMICAL ADVANTAGES OF SMALL HOSPITALS, OR VILLAGE INFIRMARIES, FOR MANUFACTURING AND MINING POPULATIONS.

By THOMAS J. DUNOTT, M. D., *of Harrisburg, Pa.*

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

It is my purpose on this occasion to direct your attention to a want, experienced in almost every manufacturing or mining region. In a brief survey of the subject, it has been thought best to make some reference to the general question of hospital relief, in order to bring out, by contrast, the points which at the present hour most interest us. As an introduction, I will quote a paragraph from an essay written by the "Father of American Medical Literature," nearly one hundred years ago: —

"Hospitals, with all their boasted advantages, exhibit at the same time monuments of the charity and depravity of a people." . . . . "The Emperor of Persia, being asked why he did not build hospitals, said, 'I will begin by making my subjects rich, and then there will be no need of hospitals;' when he should have said, 'I will make my people rich, and then I will build hospitals.'" "Wealthy nations have need of hospitals, because fortune subjects them to a thousand accidents; but it is plain that transient assistances are better than perpetual foundations. The evil is momentary, and the succor should be of the same nature."

This quotation is selected from an essay written by Dr. Benjamin Rush about the beginning of the present century. Now that we are closely treading upon the heels of our centennial year, it is eminently proper to ask ourselves the question, — To what extent do the opinions of the first sanitary author on the subject of hospital relief accord with our own? We might also inquire whether we have in our growth been compensated by a commensurate acquisition of increased civilization; or "have we armed the elements against our health, as the price paid for its blessings?" Are hospitals, as they now exist, only monuments of that which is good and that which is evil in human nature; or are they, in consequence of our higher plane of social vision, established, not only to facilitate the recovery of the sick and injured, but likewise to instruct and improve the people, as well as the physicians? If the latter are not the combined objects, is it not possible to make them objective points, which we may succeed in reaching during the present generation?

A century ago the progress of the mechanical arts made but small havoc upon life by accident and violence. To-day, the case is widely different. The application of steam as a motive power has made a change, and the consequent use of railways, and especially the almost universal employment

of machinery for increasing the product of manufacturing and mining industries, has caused a certain constant damage to life and limb. Aside from the aggregate of injury which is dependent upon the application of mechanical force, we must also consider that which is the consequence of ignorance, It must be remembered that the employment of machinery has correspondingly lowered the necessity for intelligence on the part of the laborer. The man is often as much of a machine as the implement he handles, and just as ignorant of sanitary laws as is the machine of the relation of its parts to each other. All persons are prone to neglect duties which they do not understand, or at least to be indifferent in their performance, and there is consequently, in the aggregation of a large laboring population, a source of danger from ignorance of sanitary law, especially in localities where local causes of disease can easily be quickened into activity. The welfare of every community will then largely depend upon the knowledge it has respecting the laws which govern the origin of contagious disease, and the means taken to prevent its spread, when once it obtains a foothold. With communities as with individuals, the prerequisite for financial success is the possession of healthy vigor. It becomes, therefore, a matter of economy, as well as a public duty, to provide for every unsanitary contingency which may endanger the general welfare. How much is lost by sickness is well illustrated in a series of lectures given by Prof. M. von Pettenkofer, of Munich, Bavaria. He states that the general yearly average of enforced idleness from sickness amounts to twenty days for each inhabitant of that city, which has a population of 170,000 persons. At the usual rate of wages, it entails a loss of $680,000. The incidental losses consequent upon the interruption to business, and the frequent calamity of death, easily double the amount, so that, in his estimation, $1,360,000 is the yearly pecuniary detriment to a city of 170,000 persons. Making every allowance for the inaccuracy of statistics, it is easy to see how great is the burden every community must shoulder, when pestilence or epidemic disease prostrates the energies of its industrious people.

It is admitted that all places are not equally unhealthy; many places fortunately situated, and free from exciting causes of disease, are rarely or never visited by migratory pestilence; and from the nature of the trades pursued by the people, they are not often called upon to witness the calamities which attend the vocation of the miner, or that of the mechanic in care of machinery. Under such circumstances no one would expect to discover any great public anxiety with regard to the possible outbreak of sickness, or much concern about the best way to prevent it, or much endeavor to found and support institutions, where those requiring it could be provided with medical and surgical care. Every allowance can be made for the absence of public sentiment, when there is no evidence that the interests of society demand its expression; but when, on the other hand, the occupations of a people are necessarily attended with frequent casualties, or recurring fluctuations in business affairs give rise to poverty and consequent sickness, it seems to be culpable negligence not to make provision to meet all exigencies. The misery or suffering of our fellow-beings appeals to our better

nature with a voice not to be disregarded. In large cities, where it is mostly observed, the stimulus to provision and timely preparation of the means of needed care has been sufficient. There, every known disease, whether medical or surgical, can be treated by those most competent in their institutions, endowed by public or private benevolence with ample means, and every useful appliance to assist recovery.

It is not so, away from the great centres of population; and the aggregate suffering throughout the land, consequent upon the want of hospitals and timely hospital relief, must be very great. Especially is this the case in localities where mining and manufacturing interests largely predominate; such business-pursuits always attract a large floating population of laborers, who seek work wherever they can find it. With such populations, the casualties of daily life are very numerous; their neglect of sanitary obligations is very persistent, and in consequence, sickness produced by carelessness and filth is nearly always present to a great degree. Our endeavor should be to improve this condition of affairs. We believe that the logic of facts, and the results of experience, constantly brought forward, will convince the public mind that true economy dictates a sufficient outlay of money by legislative provision, to support a widely distributed hospital system. In Pennsylvania this attempt has been already made in the right direction, for during the legislative session of 1874, an Act was passed "To provide for the support out of the County Treasury of the sick and injured poor, when under treatment in hospitals, in certain cities and boroughs." This act has five sections.

Section 1, Provides that the Managers or Trustees of any hospital which is now, or which may be hereafter established and duly incorporated, in any borough or city of the State, of not less than 20,000 inhabitants, be authorized to make requisitions quarterly, upon the County Commissioners of the county in which such hospital may be situated, for the support of such poor patients as are unable to pay for their treatment; for which requisitions the commissioners shall grant orders upon the treasurer of the county, who shall pay them to the treasurer of the hospital.

Section 2, Limits the amount allowed for the support and treatment of any poor patient to one dollar per day, and forbids a greater yearly expenditure than $5,000.

Section 3, Provides that the hospital shall not be under the control of any religious sect, and also dictates who shall be admitted, and requires that its official reports shall be made to the Board of Public Charities whenever it demands them.

Section 4, Limits the benefit of the act to hospitals whose endowment funds are less than $5,000 yearly, and requires that their property shall be owned in fee simple and be free from incumbrances.

Section 5, Provides that when the poor patients have no legal settlement in the county, where the hospital receiving them for treatment is situated, it shall be the duty of the managers to notify the directors of the poor of the county, in which they *have* legal settlement, and that for thirty days only they shall be responsible for charges, except that they have been notified within that period.

The practical effect of all such legislation will be to divert a portion of the money of the State towards the support of citizens, not paupers, who are much in need of medical or surgical care. Eventually, it would result in depleting the almshouse of those compelled to go there by reason of poverty arising from sickness or injury, because there was no other refuge, but whose self-respect is lowered by being classed and associated with the depraved professional mendicant. The extensive usefulness of such proposed hospital provision, in conjunction with a Central Sanitary Board of Control having its branches in each county, would leave but little to be desired. The aggregate gain to the Commonwealth in lives saved and sickness prevented, would be immense. An appeal from this Association in favor of such State legislative action, would no doubt largely awaken public interest, and the efforts of those living amidst mining and manufacturing populations to provide suitable small hospitals, would meet with more success in the future than they have in the past.

We have so far referred only to the reasons why such institutions are needed, but we may, perhaps, profitably look at the subject from another standpoint. Every hospital so located is a school of instruction to those concerned in its management, its visitors, and its inmates. The clean floors, the tidy walls, the method of ventilation, the temperature of its wards, the construction of the building best adapting it to secure the essentials of light, warmth, and pure air, are always both to inmates and visitors suggestive of similar home-comforts. The class of persons who mostly become patients are deficient in sanitary knowledge, and proverbially careless with reference to their domestic surroundings. When they leave the hospital, it is probable that many will remember what they see and hear about the necessity of cleanliness in disposing of putrescent filth in order to avoid the engendering of contagious disease. Sanitary education is more needed by the laboring man than by those whose means permit them to live under more favorable circumstances. In the habitations of the poor chiefly originate the first cases of the fatal epidemics, which, skipping from the hovel to the mansions of the rich, make broad tracks of devastation in their course. Society cannot afford to neglect the sanitary education of the poor; the consequences are too serious. Preparation for disaster of this character is, outside of large cities, mostly neglected, but in small towns having their local hospital, the precautions necessary would be more apt to be known, and to be enforced by the proper authorities.

No disease could insidiously spread without public attention being directed to it, in consequence of the demand made upon the hospital to receive some of those attacked, and attention thus being awakened by danger, public effort would be made to avoid it. Isolated cases of dangerous infecting disease may exist, and no one but the doctor be the wiser; shut such cases up together in a quarantine inclosure and the whole community stands afar off.

The hospital thus becomes a school of sanitary instruction to a portion of the community most apt to resent and resist the efforts of the health officer to give them pure air in clean homes. *In this connection* I here refer

more especially to small hospitals or village infirmaries, established where they are most needed, among manufacturing and mining populations. Such establishments, however, cannot be maintained unless the State provides by suitable laws for their partial support. The assistance thus provided could not possibly be abused. That to ask for such assistance is a legitimate petition, all admit, for progress in mechanical arts and mining brings a thousand risks to men, women, and children, who, in more primitive social conditions, would not have been subjected to risk of bodily harm or filth diseases. Now there is no asylum for them but the almshouse with all its demoralizing and degrading influences. The constantly increasing demand for taxes to support these institutions, and to rebuild in magnificent style and proportion those dilapidated by age, is diverting the public funds into a vicious channel from which there can be no adequate return. Individuals once drawn into the vortex of pauper associations, rarely take their place again in the ranks of the self-respecting and self-sustaining members of society.

Hospital-relief has been in the past mostly given to paupers: can it not be made to flow in such directions that it will be largely distributed to those made temporarily poor by stress of circumstances over which they have had no control? Cannot the honest working man, laid low by disease, have the happy consciousness that the benevolence and wisdom of the community in which he lives and for which he labors, provide for him in his hour of adversity a more congenial temporary home than the county almshouse?

The feasibility of the suggested plan to establish small hospitals may be questioned. To my knowledge two have been organized, and perhaps others of which I have no knowledge. One of the two at Harrisburg and the other at Bethlehem, Pa. Both are in successful operation, and within the last two and a half years, have treated nearly two thousand patients. Other cities than these two in the State of Pennsylvania, have funds available for similar purposes, and when a sufficient amount is secured, propose to erect suitable hospital structures, when these beneficent institutions will go into operation, secured by partial support from the State. No better ambition can animate the true hygienist and philanthropist than that which prompts him to the endeavor to change such indifference into public zeal; and this, when accomplished, would serve as a landmark between the past and the future. Hospitals would no longer be "monuments at once of the charity and the depravity of mankind," but in their numbers, judicious distribution, and location, their sanitary outfitting and wise management, and their acknowledged usefulness, they would be as indicative of the moral growth of a people, as their mines, manufactories, and mills are of their material prosperity.

RELATIONS OF SYPHILIS TO THE PUBLIC HEALTH.

By FREDERIC R. STURGIS, M. D., *of New York.*

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 12, 1874.

THE subject treated in the following pages will be considered under three heads: —

1. Is syphilis of common occurrence?
2. Can it be considered a disease fatal to life? and
3. Does it favor the development, or fatally influence the course of other diseases?

Before answering the first question, let me state the plan I have adopted. In the first place, I have made the distinction between the different varieties of venereal diseases, namely: gonorrhea, chancroid (so-called), and syphilis proper; and to this latter I have for the most part confined my attention. These three diseases must not be confounded together in your minds; they are totally different. In the next place, in collecting my own statistics, I have gathered together the sum total of poor patients treated during the year 1873 at the various hospitals and dispensaries of New York city. Of these institutions, I have selected a certain number, and have, from examination of their books, ascertained the number of patients treated during two months of the year — January and August being selected as presenting a fair average. I then found out how many of these patients were afflicted with venereal diseases; of these venereal patients, how many were the subject of syphilis (acquired and congenital); and, with this knowledge as a basis, I have estimated the total number of venereal and syphilitic poor patients, and the percentage they bear to the total number. But this only disposes of those who come for treatment to our public institutions, and does not include those treated at their homes, at physicians' offices, and by apothecaries and quacks.

And this after all will only be an estimate, and a defective one at that, from the impossibility of obtaining any absolutely positive knowledge on the subject. Still the figures will be of some value in determining whether the disease is widely spread or not. A specialist in this class of diseases, judging from his own experience alone, might say, in his haste, all men are syphilitic; while another, who saw but little of it, would as confidently assert that it was comparatively rare. Both would be wrong; the truth lying in that golden mean between the two statements, which from time immemorial has been declared the safest course. And this in my opinion, careful statistics give us. I shall begin with the reports of the Armies and Navies of Great Britain and the United States, following these with the reports of the Mercantile Marine of the United States; then I shall take up the statistics

of New York city, comparing them with Mr. Wagstaff's report made to the medical officer of the Privy Council of England for 1866, and finally review the opinions of other authors and statisticians. In the United States, the army statistics between the years 1840 and 1859 show an aggregate strength of 187,144 men; of these 2,169 suffered from syphilis; a percentage of 1.1. For the five years from January, 1870, to September, 1874, inclusive, the total strength of the army in the Department of the East was 35,206; the total number of venereal cases was 2,920; while the total number of syphilitic cases was 1,488. Expressed in percentage, that of venereal to the total strength of army would be 8.29; of syphilis to total strength of army would be 4.22; and of syphilis to venereal 50.95.[1] The report of the Mercantile Marine for the United States for 1872 and 1873 gives the total number of patients treated at 24,645; of these the venereal cases amounted to 4,170; or over 16.92 of the total number of patients;— and, of these, venereal 3,779, or 15.33 of the total number of patients, were due to syphilis. The percentage of syphilis to all venereal diseases was over 90.38.[2] The report of the Mercantile Marine of New York city gives a still more disastrous result. From January, 1871, to October, 1874, the total number of patients was 6,275; of these the venereal cases amounted to 1,532, or over 24.34 of the total; and of these venereal cases 1,016 or over 16.19 were syphilitic. The percentage of syphilitic to venereal cases was over 66.31. Of the British Army, I have collected the reports for 1869, 1870, and 1871, and for that period we find the aggregate strength of the army to be 388,221: of these, 58,960 or over 15.18 of the whole army were venereal cases and of these, syphilis is credited with 29,851 or 7.68 of the entire force. The percentage of syphilitic to other venereal diseases is 50.62.[3] Of the naval reports of the United States, I have obtained the statistics of the Naval Hospital of Brooklyn, N. Y., for the years 1870 to 1874. The total number of patients admitted into hospital for these five years was 1,385; of which 199 or 14.36 per cent. were venereal. Of these venereal cases, 119 or more than 8.59 per cent. were due to syphilis. The percentage of syphilis to total venereal diseases was over 59.79 per cent.[4]

For New York city the total number of hospitals and dispensaries amounts in round numbers to 46, where annually 280,536 patients are treated. From these 46 institutions, I have selected 11 to serve as a basis for estimating the amount of venereal and syphilis in this city.[5] During the two months I have selected, January and August, 1873, I found the total number of patients treated at these hospitals and dispensaries amounted to 32,549; and of this number, 1,458 were venereal. The syphilitic cases come to 595.[6] Expressing this in percentages, that of venereal to total number treated is 4.4, or 44 in every thousand patients; that of syphilitics to total number treated, is 1.8, or 18 in every thousand patients; and that of syphilitics to total number of venereal cases, is 41, or 410 syphilitic in every thousand venereal patients. If now we take the total of poor persons

[1] Appendices A and D.
[2] Appendix B.
[3] Appendix C.
[4] Appendix E.
[5] Appendix F.
[6] Appendix H.

who received gratuitous medical aid in New York during 1873 as 280,537,[1] and compute the percentage of venereal at 4.4, we find that in that city the indigent venereal amount to 12,341 persons, while out of this number 5,045 are cases of syphilis. But this manifestly takes no cognizance of private cases: what proportion of the number of venereal shall we assign to them? When I gave the statistics of the Mercantile Marine — and these perhaps are as good as any upon which to base an estimate, coming as they do from official sources — it was found that the percentage of venereal to total number of cases ranged from 16 to 24 per cent. Call it, as an average, 20. That would be nearly five times as much as the percentage I give for the venereal poor of New York, thus leaving four fifths to be accounted for. In the same reports we found that the percentage of syphilis to total number was over 16, — that is, about ten times as much as my estimate; thus leaving nine tenths to be accounted for. If we adopt this view, we should have a total of 49,364 persons treated privately for venereal diseases in New York, of which 45,405 would be syphilitic. In other words, out of a population of 942,292, 61,705 would be suffering from venereal diseases in some form; and, of this, 50,450 would be due to syphilis.

To avoid, as far as possible, all sources of error in collecting the statistics of public institutions, besides examining the books of the skin and venereal departments of the hospitals and dispensaries, I went over those of the womens', childrens', and surgical departments as well; and, notwithstanding all the care taken, I feel that the *true* amount of syphilis, even among the poor, exceeds the amount here stated; and I take this opportunity of pointing out how defective and careless the registration of patients seems to be, — a well-kept record book being the exception; thus rendering accurate statistics well-nigh impossible.

Mr. Wagstaff, in his reports,[2] calculates the percentage of venereal to total number of poor patients as 6.92 (mine was only 4.40) of syphilitic to total number of poor patients as 3.53 (mine was 1.80), and the percentage of syphilis to all venereal diseases as 51 (mine was 41). His observations are based upon times varying from one day to one week. He says, in summing up his report, "If this report be considered extensive enough (and it comprises about a week's observation of presumably one quarter of the sick poor of London) to warrant general deductions being made, it may be inferred that, among the million and a half of poor population of the metropolis who receive medical relief for disease at hospitals, dispensaries, workhouses, and at the hands of the parochial medical officers during the year, nearly 7 per cent. or about 1 in 14, are affected with venereal disease of some kind. These numbers, it must be remembered, do not include midwifery cases."

Of the French statistics, I am sorry that I cannot present you with the official returns of the army and navy. I must, therefore, depend upon figures furnished recently by M. C. J. Lecour, Préfet of the French police, in his report, "La Prostitution à Paris et à Londres."[3] He gives, for 1868, the total number of venereal patients treated in Paris at the hospitals, including the four military ones of Val de Grâce, Gros Caillon, St. Martin, and Vin-

[1] Appendix F. [2] Appendix G. [3] Appendix K.

cennes, as 9,796. This includes no private cases. He then goes on to say: "We may consider these figures as one fifth of the total number of venereal patients in Paris who are treated at their homes by physicians, or who seek relief at the hands of apothecaries and charlatans. If this be so, we get a sum total of 48,980 cases, a formidable array, and one probably much below the real amount."

My second proposition is, whether syphilis can be regarded as the cause of a large number of deaths; and, in answer thereto, I say, *No!* An English writer on this subject says: "I have every now and then cases of tertiary symptoms which return again and again, and offer most rebellious instances of the virulence of the disease amongst the weak and debilitated; but still death from syphilis is almost unheard of in private practice" (Acton). And even among the poorer classes of society, death from this cause is not common, as I hope to be able to show you further on. To deal with this subject clearly, I shall separate the deaths from acquired and those from congenital syphilis; we can then see plainly in what class of cases syphilis is especially to be dreaded. I have compiled the statistics from four of the leading London hospitals, from the Charity Hospital, on Blackwell's Island, New York, and from various other sources; and to those who think that acquired syphilis is a fatal disease, the result will be surprising. The four English hospitals I have selected are St. Bartholomew, St. Thomas, St. George, and the London. Here are the results: —

At St. Bartholomew, for twelve years (1860 to 1871 inclusive), 2,292 cases of syphilis were treated; of these twenty-three died, — a little over one per cent. At St. Thomas's, for six years (1866 to 1871 inclusive), 130 cases were treated; of these six died, — a little over four per cent. At St. George, for five years (1866 to 1870 inclusive), 287 cases were treated; of these five died, — more than one and a half per cent. At the London, for three years (1863 to 1865 inclusive), 209 cases were treated; of these seven died, — a little over three per cent. At the Charity Hospital, New York, for four years (1854 to 1857 inclusive), 5,668 cases were treated; of these fourteen died, — a little over two tenths of one per cent.[1] It may be urged against these statistics, that although deaths in the hospitals were so few, many may have died outside, — accidents which have not been taken into account. But this objection, upon examination, is more apparent than real; first, Because the cases admitted into hospitals are the severe ones, such as would be most likely to prove fatal; in fact, going into hospital is looked upon as the *dernier ressort;* and second, extending, as these observations do, over a series of years, those cases which ultimately prove fatal would probably return to the hospital to end their days, and would thus figure in the reports. If, therefore, we find such good results under such unfavorable circumstances as hospital patients generally show, we may, I think, fairly assume that the mortality outside is not very great. These figures comprise only the secondary and tertiary forms. I have purposely omitted the primary lesions and congenital cases, as the former never in themselves prove fatal; and the latter do not come into a consideration of deaths from acquired syphilis. We have, then, a total of 8,586 cases, of which fifty-five

[1] Appendix L.

died, — under one per cent. Let us see what are the causes of death in these cases.

On this point the London and Charity Hospitals are silent; St. George gives the cause of one only, — œdema glottidis, from necrosis of the thyroid cartilage, causing suffocation; St. Thomas gives one, where the patient died from the effects of gummata of the brain; and St. Bartholomew gives the cause of fourteen of its twenty-three cases. They are, first, tuberculosis, apparently independent of syphilis; exhaustion of two of these after tracheotomy; two pleurisy and bronchitis, not stated as syphilitic; one peritonitis and anal fistula, and one erysipelas.

Turning now to the mortuary records from syphilis in cities, let us select those of London, New York, and Philadelphia. In London, for 1871, the total number of deaths was 80,434; from syphilis, 352, — a little over four tenths of one per cent. of the whole number of deaths. In New York, for 1871, the total number of deaths was 26,976; from syphilis 142, — a little over one half of one per cent. of the whole number. In Philadelphia, for 1871, the total number of deaths was 16,993; from syphilis 19, — a little over one tenth of one per cent. of the whole number. Allow me here to say — what I suppose has occurred to you long ere this — that, very probably, these figures do not strictly represent all the deaths from syphilis. I will grant the proposition; I do not think they do. To give full allowance for all possible errors in registration, we will double the number of deaths due to syphilis; not that I really believe that amount of error to have been made, but to give the fullest possible latitude. The figures would then read: —

London, 1871, percentage of deaths from syphilis to total number — eight tenths of one per cent.

New York, 1871, percentage of deaths from syphilis to total number — one per cent.

Philadelphia, 1871, percentage of deaths from syphilis to total number — two tenths of one per cent.

Candidly, is that such a large percentage, even with this increase of one hundred per cent? Let us see how the deaths from syphilis compare with those from some of the zymotic diseases, *e. g.*, scarlatina, typhoid fever, measles, and small-pox.

	Total Deaths.	Scarlatina.	Typhoid Fever.	Measles.	Small-pox.	Syphilis.	Percentage of Syphilis to Total Number of Deaths.
London, 1871[1] . . .	80,430	1,902	871	1,427	7,912	252	$\frac{2}{5}$
New York[1]	26,976	791	239	409	805	142	$\frac{1}{2}$
Philadelphia[1] . . .	16,993	262	313	41	1,879	19	$\frac{1}{10}$

[1] Clarendon or Egypt.

Before passing on to a consideration of the mortality in congenital syphilis, let me present a series of statistics,[1] which is not open, at least to one objection, the *mauvaise honte*, which, perhaps, causes some false returns to be made as to the true cause of death. In the American army, from 1840 to 1859, the total number of cases of syphilis is computed at 2,169. Among these there were thirteen deaths, or a little less than six tenths of one per cent. of the total number of cases.[2] In the British army, for the three years, 1869 to 1871 inclusive, the total number of syphilitic sick was 29,851; among these thirty-two deaths occurred, — a little over one tenth of one per cent. of the entire number. Even if we include those who died, were invalided, and discharged the service from this cause, it only amounts to 460 men out of a total strength of 388,221.[3] In the light of these figures shall we consider syphilis a fatal disease? Decidedly not!

But there is one aspect in which syphilis is especially mischievous, and that is in the congenital forms of the disease. To this phase of syphilis let me now ask your attention. We found that in London, during 1871, the number of deaths from syphilis was 352; of these thirty-eight occurred between the ages of five and ninety-five. In New York, during 1871, the number of deaths from syphilis was 142; of these twenty-two occurred between the ages of five and ninety-five. In Philadelphia, during 1871, the number of deaths from syphilis was nineteen; of these seven occurred between the ages of five and ninety-five. What has become of the remainder? In London, for the year 1871, 314 infants under five years of age died from syphilis; and of this number, 281 before the completion of their first year. In New York, for 1871, 120 infants under five years of age died from the same cause; and of this number, 113 before the completion of their first year. In Philadelphia, for 1871, twelve infants under five years of age died from syphilis; and of this number, ten, before the completion of their first year.

To present it more concisely: in London, 1871, percentage of deaths under five years, to total of deaths from syphilis, was over eighty-nine. In New York, 1871, percentage of deaths under five years, to total of deaths from syphilis, was over eighty-four. In Philadelphia, 1871, percentage of deaths under five years, to total of deaths from syphilis, was over sixty-three.[4]

Large as these figures seem, they are borne out by the statistics of other

[1] Appendixes C and D. [2] Appendix D. [3] Appendix C.

[4] Let me here correct an error which has crept, doubtless inadvertently, into the papers of Professor Gross, read at the last meeting of the "American Medical Association," at Detroit; and of Dr. Hartshorne, read before this society. I am made to say: "In Philadelphia and New York, the loss of life from this cause, counted for several years, in children under five years of age, is eighty per cent." This is a mistake. What I said was: "The larger proportion of deaths from syphilis occurs in subjects under five years of age; indeed, if we may rely upon the published statistics, the average mortality is nearly eighty-five per cent. for New York City, and over sixty-three per cent. for Philadelphia." * And again: "From this it would seem that over eighty per cent. of the deaths from syphilis in the City of New York occur in children under five years, and over sixty per cent. in Philadelphia.†

* *New York Medical Record*, February, 1874. † *American Journal of Medical Sciences*, July, 1873.

countries. In the Moscow Hospital of Russia, for the eleven years, from 1860 to 1870 inclusive, the percentage of deaths among syphilitic children ranged between sixty-three and eighty-two.[1] In Sigmund's wards, in Vienna, as collected by Dr. Pick, out of sixty-one births, all but two are known to have died. Of these sixty-one births, seventeen were premature; forty-four at full term. Of the seventeen premature births, eleven were born dead; of the forty-four at full term, three. Of the forty-seven living children, four lived more than three months, and in two the result was unknown. Of the remaining forty-one, the mean duration of life was twenty-six days; the shortest period being one hour, the longest ninety days.[2] Before leaving this question of the mortality of syphilis, let us compare the syphilitic deaths of previous years with those of 1871, to see if the number has increased or diminished. We will take England and the United States as a basis of comparison; and, dividing the time into periods of ten years, we find the number of deaths in England from syphilis, from 1841 to 1851, was 598. From 1851 to 1861, 1,177. From 1861 to 1871, 1,742. In the United States, between 1840 and 1850, the number of deaths from syphilis was 146; between 1850 and 1860, 233; between 1860 and 1870, 590. In cities, the rate of mortality from the same cause has also increased; thus, in New York City, the number of deaths from syphilis in 1866 was forty-four, while in 1871 it was 142; and in Philadelphia the numbers stand, twenty-two in 1866 against nine in 1860; but for the year 1871 there was a decrease, from some cause, only nineteen being credited to syphilis.

The reason for this increase is perhaps due to improved and more careful registration; and, although these figures do not absolutely represent all the deaths from syphilis, they are not very much out of the way. Moreover, should we decide to reject them totally as untrustworthy, then must we reject all mortuary statistics as liable to the same objection. Thus, with regard to scarlatina, the patient may die of nephritis; the death would then be recorded as one of nephritis, and not of scarlatina, to which latter disease, however, it properly belongs. Faulty as figures are, they are in the long run a safer guide than vague statements based upon personal belief. The latter are too frequent. In a paper written in the "Westminster Review" for July, 1869, the most astonishing statements are made of the ravages produced by syphilis, and marvelous modes of transmission to the infant through the mother's milk. Even Sir William Jenner, President of the Epidemicological Society, of London, in his address delivered at the opening of the session of 1866 and 1867, makes the following statement *ore rotundo:* "Syphilis, more often than has been commonly believed, means death, — death to the primarily syphilized, and death to his offspring." Is this strictly correct? Does syphilis mean death to the primarily syphilized? If it does, how can we reconcile the large number of cases coming under treatment with the small number of deaths; small even when the number recorded is doubled The danger to the public health from syphilis is not so much from those who acquire the disease as from those who inherit it. This fact does not appear in a large mortality, but in a vitiated vitality, and a tendency to degeneration

[1] Appendix M. [2] Appendix N.

of tissue of those who inherit it. The third point is, *Does syphilis favor the development, or fatally influence the course of other diseases?* Marowski, in a paper contributed to the "Deutsche Klinik" for 1863, says: "It is, nevertheless, very probable that the children of such (syphilitic) parents receive a certain morbid predisposition; *e. g.*, to scrofulosis, hydrocephalus, phthisis pulmonalis." The question has often been broached, — "Is scrofula syphilis," and it has been variously answered, according to the belief or predilections of the writer. Scrofula can no more be considered due to syphilis than to tuberculosis, to cancer, or to malarial influences. A large number of children born of parents, where one only is seemingly diseased, — notably the father, — are healthy; this may also be the case where both have been infected; such children, then, have neither inherited syphilis nor any degenerated tendency, so far as syphilis is concerned. Only those show these morbid predispositions who have had evidences of the disease; but no child goes through the early years of life free from symptoms, to suddenly break out at puberty or in adult life with so-called latent syphilis. Then those cases of scrofula, rickets, etc., said to originate from syphilis, no more do so than do these same diseases, when they occur in children — the offspring of phthisical persons; *syphilis can only produce syphilis*, it cannot produce phthisis any more than it can measles; but syphilis endows the child with a vitiated, enervated frame, if it happen to survive the first few years of its existence, and renders it prone to succumb to any extra strain imposed upon it, and less able to resist attacks of sickness than a healthy child. This view does not militate against the possibility of the child inheriting a tendency to other diseases besides the syphilitic taint; *e. g.*, phthisis, rheumatism, or gout. In this view I am sustained by Mr. Hutchinson of London.[1]

Before leaving this question, let us consider what influence syphilis exercises upon traumatism. And here we enter upon a field which has been much better worked up than the one we have just left. Verneuil, and after him Fournier, Dion, Petit, and others, have devoted attentive research to this subject, and those who study their writings, scattered about in various journals and monographs, can scarcely fail to be convinced of the fact that syphilis *may* exercise a very marked effect upon wounds and injuries; not only those which are recent but such as are old. Yet this condition is by no means constant, and is very often induced by some local or accidental cause, namely, attrition, neglect, and dirt, as well as constitutional defects, *i. e.*, debility, scrofula (?), or cachexia. If this be true, then the more advanced the stage of the syphilis, the more likely are the injuries to assume a specific appearance. The German writers are not so ready to acknowledge this influence as the French; and Merkel,[2] at the end of his paper upon this subject, arrives at the following conclusions: —

1. Syphilis does not usually affect the natural evolution of wounds.

2. It (the syphilis) shows itself if infection has occurred a short time prior to the traumatism.

[1] *Medical Times and Gazette*, December 14, 1867.

[2] *Centralblatt für Med. Wissenschaft*, 1871.

3. Wounds, even when serious, such as those of joints, or when accompanied by phlegmonous inflammation, are not, as a rule, affected by the existence of an anterior specific diathesis.

4. The manifestations of syphilis following traumatism are generally cutaneous, and appear upon the border of the cicatrix or upon those portions of the skin which are usually affected.[1]

In a paper like this, all that can be done is to point out the results of syphilis in the various relations mapped out in the beginning of this paper, leaving the details to be studied at leisure by those interested in the subject. I am therefore compelled to omit much excellent material for discussion, and many cases of interest. The cases given relate to the influence which an early syphilis may exercise upon wounds and bruises. I now invite attention to what happens in a more advanced period. Dion and Fournier[2] give three cases of extreme interest in this connection. Dion furnishes two of them, which I will give first: "Two patients who had been wounded three or four years previous to their contracting syphilis, in the course of the disease were subjects of the following changes. One was the bearer of a large cicatrix of the skin, the other had a callus of the leg, both as the results of their wounds. From syphilis, the one who had the cicatrix noticed that it became extremely painful, and the seat of a tubercular eruption, while in the one with fracture, the callus became so soft as to oblige him to wear an apparatus to enable him to walk. Under treatment the symptoms disappeared, the cicatrix became indolent, the callus solid." In Fournier's case, "the young man had been infected five or six years previously in China. Three years before he had been shot, and the clavicle and first two ribs broken. These fractures consolidated without trouble, but in the course of April, 1875, a periostosis appeared upon the tibia, while the seat of the old fracture at the same time became the point of an enlargement the size of four fingers. The iodide of potassium caused the complete disappearance of the swelling." In these cases, the last one at least, the syphilis which reacted upon the traumatism was of several years and of an advanced type when it did appear.

On the other hand, the Germans do not seem to attribute this influence to syphilis so freely as do the French writers. Ziessl, in the "Wiener Medz. Wochenschrift," 1865, No. 19, is very skeptical as to this power of

[1] Ambrosoli reports, in the *Gaz. Med. Italiana*, two cases, — one where, during the existence of a papular syphilide, a wound of the index finger was followed by exfoliation and loss of the upper phalanx which was finally cured by the iodide of potassium; and the other, where a prick on the hand of a person suffering from a squamous syphilide of the palm of the hand and sole of the foot, was followed by an ulceration, syphilitic in appearance, and amenable to anti-syphilitic treatment only. Verneuil, by H. L. Petit,* gives a case where continued friction upon a bunion in a syphilitic subject produced an ulceration which would only heal under the use of mercury. In this case there was a papular eruption of the body. H. L. Petit (*op. cit.*) narrates an instance where an ulceration followed a bruise of the leg. In this patient an indurated chancre had preceded the contusion by one month. Petit gives no history of the subsequent lesions. The "liqueur de Van Sweeten" was used with success.

[2] Quoted by H. L. Petit, *De la Syphilis dans ses Rapports avec le Traumatisme*, Paris, 1875.

* H. L. Petit, "De locis minoris resistentiæ," *Gaz. Hebdomadaire*, Sept. 3, 1875.

syphilis, stating that he had seen in his own and others' practice, wounds from operations and other causes recover at once in cases where syphilis was in full bloom. He quotes from authors who state that syphilis does retard healing of lesions, notably one case by Snidiaur, where a fractured leg in a syphilitic patient did not recover until a specific treatment was adopted. Following him in the same journal is Dr. E. Thoman, of the Rudolph Hospital, who expresses much the same opinion, and gives the case of a soldier wounded at the battle of Grosswardien, and who had both feet frozen. Chopart's operation was performed, and notwithstanding he had syphilis, as evinced by various symptoms of cutaneous and sub-cutaneous syphilides, the cicatrix of a chancre and other unhealed ulcers of the penis, the union was by the first intention. The syphilis went on.

It may well be questioned if syphilis, in itself, — that is, when it occurs in a previously robust man — does exercise any special influences upon wounds during its early stages. When the disease has broken down the constitution, when cachexia supervenes, or when the disease occurs in sickly or delicate persons, then, I admit, that the diathesis may play a very important part in the course and treatment of any accidental injury. I recall one case in my own experience where the patient from a slight blow upon his knee had an attack of synovitis, which resisted all treatment except one by mercury and iodide of potassium. He had been under my own and others' care for various syphilitic lesions, all of which had shown a tendency to take an ulcerative and inflammatory action, and he was beside of an unwholesome and cachectic habit of body. What induced me to use mercury and iodide of potassium was the appearance of a swelling of the clavicle while he was laid up with the synovitis. This also disappeared under the mercurial treatment. Another cause, perhaps, which may induce a wound to assume a syphilitic aspect, is dirt and friction, — a condition of things which might make the simplest wound assume an unhealthy appearance. Thoman (*op. cit.*) gives expression to the same opinion: "That a wound in a weak, pale, debilitated subject, who is syphilitic besides, may, from the least cause, such as slight pressure, show a tendency to become unhealthy and assume a syphilitic aspect, is as undoubted a fact as that a similar wound may, under proper care and attention to cleanliness, heal without any untoward accident as any other wound would." He then gives the notes of a case which occurred in the practice of Dr. Ulrich, where from secondary syphilitic ulcerations of the epiglottis and subsequent œdema glottidis, tracheotomy was performed. Some days after the operation, the lower edge of the wound assumed a dirty look, the walls became hard and inverted and presented the appearance of a chancrous ulcer (*eines chancrösen Geschwürs*), while the upper border showed nothing different from any ordinary incised wound. That the same wound should show a different appearance at various points of its periphery gave rise to observation and reflection, when lo, the problem was solved? It was noticed that the lower border of the canula rested upon and rubbed against the lower edge of the wound (this was favored by the movements of the patient himself); this irritation induced an unhealthy look in the lower edge of the wound, lending it a syphilitic aspect, while the upper portion,

free from this irritation, preserved its clean healthy look. In the case which I cited as coming under my own experience where the syphilis seemed to have stamped its own peculiarities upon an accidental injury, it will be noticed that the patient was cachectic and in a bad condition generally. That, I incline to believe, may have had much to do with the result: but where the subjects of a syphilis, either past or present, are tolerably robust, I believe that the disease will have but little influence. If the syphilis in itself, apart from any conditions of general health, *does* have the property of endowing a wound or other injury with its characteristics, then every abrasion, scratch, or tear in such cases would become syphilitic, or tend so to become, whereas general experience shows the contrary.

But how is it in congenital syphilis? As a rule in such cases, injuries assume a peculiar look, and remain obstinate to every mode of treatment but a mercurial or iodidic one, and operative procedure should be carefully avoided, if possible. But even in these cases we are not necessarily debarred from operating when requisite, provided we adopt certain precautions in the way of treatment before and after the operation. This was very nicely shown in a case which I have had lately under my care. It was one of interstitial peratitis in a girl twelve years of age, where there was a distinct history of congenital syphilis; the mother who came with the child was also syphilitic. Under treatment long continued, the peratitis of one eye cleared up very nicely, in the other the opacity was central and did not clear up. Treatment had been suspended for some little while before I decided to perform iridectomy, which was done upwards. At first things looked badly, the cornea was very hazy and the edges of the wound a little puffy; treatment (mercurial) was at once begun again, when a marked improvement took place; the cornea is almost entirely clear and all the inflammatory symptoms have subsided. Still, notwithstanding the success in this case, I should defer as long as possible any operation in persons who are the subjects of congenital syphilis.

From the foregoing remarks, what conclusions shall we draw in answer to the questions proposed at the beginning of this paper? I think we may safely commit ourselves to these: —

1. Syphilis is probably widely spread and possibly increasing in extent. This opinion, from the imperfect means at our disposal, must for the present at least remain more or less conjectural.
2. The question of the fatality, so far as the acquired form of the disease goes, may be answered in the negative, but its excessive mortality in the congenital variety renders it serious and alarming. One cause of consolation remains, however, *i. e.* that the disease does not probably extend to the third or fourth generation, usually dying out with the second, nor does it usually transmit any specially vitiated vitality to the descendants of the original sufferer.
3. Acquired syphilis is comparatively harmless and congenital fatal, in their influence over the course and development of other diseases. The danger to the public health lies more in the transmitted, than in the acquired disease, and whether this be permanent and dangerous,

or only temporary and remediable, must remain for future investigation to determine.

Finally, the defective registration of this class of cases should be remedied. This subject was debated at the International Statistical Congress held at St. Petersburg in 1872.[1]

[1] That body proposed the following modifications, and I quote the article somewhat in detail : —

"The grave importance of the effects caused by syphilis upon the physical and moral health of the people, as well as its influence upon their beauty and reproductive powers, are so universally recognized as to render it superfluous to prove the urgency which exists — both as to our knowledge of the disease and to the practical measures necessary to combat it, — to express in figures the degree of the development of this malady among a people. Unfortunately the methods adopted in Russia and other countries to collect the statistical facts, have been pursued with so little method and system as to render it impossible to judge from figures alone, of the ravages produced by this calamity in its various forms. It appears to us, therefore, that rules should be framed to render the statistics of syphilis useful to science and to the wants of medical and sanitary practice. A summary of these rules is subjoined."

A. In Relation to the Form of a Disease :

1. To separate rigorously syphilitic infections from other diseases resulting from sexual relations (chancre, gonorrhœa).

2. To recognize as syphilitic affections of the genital organs (syphilitic chancre) only those affections which have produced (engendered) general infections.

3. To register separately cases of fresh infection and relapses (recurrences) of the disease ; (the only means of learning exactly the powers of propagation of the malady.)

B. In Relation to the Means of Transmission of Syphilis : Take note of —

1. The cases of infection from sexual contact, the surest data being obtained from the inspection of prostitutes and soldiers. The facts collected in medical institutions where suspected persons are treated would serve to control the figures collected, and that is why the data furnished by inspection need absolutely to be verified by those of hospitals.

2. The cases of infection in other ways : (*a*) by lactation, from the nurse to the infant, or vice versa ; (*b*) by vaccination ; (*c*) by the common employment of instruments in factories (those of glass, for example) ; and (*d*) by the in common employment of household utensils, linen, etc., in congregate life.

3. The cases by hereditary transmission.

Remark. It would be in the highest degree interesting to study the degeneration of populations resulting from syphilis which is transmitted from generation to generation in countries where intellectual cultivation is little developed, or when endemic syphilis begins (syphiloides), *e. g.* in the north of Siberia, in Norway, Dalmatia, in the Islands of the Grecian Archipelago, in Turkey, etc.

C. In Relation to the Degeneration of the Population :

1. Cases of abortion and premature deliveries caused by syphilis : (*a*) of the mother ; (*b*) of the father. Syphilitic degeneration of the placenta to be noted if possible.

2. Cases of death a few days after birth from want of vitality of the new-born, the result of syphilis : (*a*) of the mother ; (*b*) of the father.

D. In Relation to the Influence of the Disease on the Nervous System :

1. Cases of mental aberration.
2. Paralytic affections.
3. Epilepsy and other nervous diseases.

[*For remainder of this note, see page* 453.]

APPENDED STATEMENTS.

[A.] *Abstract of Hospital Reports, U. S. Army of the East.*

1870. (Numerical Strength of Army, 1870.)

Station	Officers.	Men.	Syphilis Primaria.	Syphilis Secunda.	Syphilitic Ulcer.	Gonorrhœa.	Gon. Orchitis.	Bubo.	Balanitis.	Epidydimitis.	Chancroids.	Strict. Urethræ.	Gon. Rheumatism.	Total.
Fort Adams, R. I.	13	192	10	6	5	6	1	4	..	..	..	..	..	32
Alleghany Arsenal	4	50	1	3	..	..	..	..	..	..	..	..	..	4
Fort Columbus, N. Y.	11	797	24	21	..	65	8	7	1	1	29	1	..	157
Charleston, W. Va.	3	56	..	6	..	..	..	..	..	..	..	..	..	6
Charlotte Station, N. C.	3	57	..	..	..	..	..	..	..	..	..	..	..	..
David's Island, N. Y.	36	845	24	14	..	12	..	..	..	..	..	..	..	50
Fort Delaware	9	166	..	..	..	5	2	..	..	..	..	..	..	7
Fort Foote, Md	4	65	5	..	..	1	..	..	..	..	..	..	..	6
Camp Foster, Vt.	9	137	..	..	..	..	..	..	..	..	..	..	..	..
Frankford Arsenal	4	50	..	..	..	1	..	..	..	..	..	..	..	1
Graham, N. C.	3	66	6	..	..	..	..	..	..	..	..	..	..	6
Camp Grant, Va.	3	62	1	..	..	..	..	..	..	..	..	..	..	1
Fort Gratiot, Mich.	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Hamilton, N. Y.	15	292	34	3	..	27	2	..	..	..	..	..	..	66
Fort Independence	7	85	4	3	..	5	..	..	..	..	..	..	..	12
Fort Johnston, N. C.	4	111	1	7	..	5	1	..	..	..	..	..	..	14
Fort Mackinac, Mich.	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Macon, N. C.	7	120	4	..	..	5	..	..	..	..	..	..	..	9
Indianapolis Arsenal	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kennebec Arsenal	1	22	..	..	..	4	..	..	..	..	..	..	..	4
Lumberton, N. C.	3	53	2	2	..	..	..	..	..	..	..	..	..	4
Madison Barracks	4	57	..	1	..	1	..	..	..	..	..	..	..	2
Naturkit Barracks	6	50	..	..	..	..	..	..	..	..	..	..	..	..
Plattsburg Barracks	3	69	..	1	..	..	..	..	..	..	..	..	..	1
Sedgwick (D.C.) Bar'ks.	8	224	6	5	..	9	..	..	..	..	..	1	..	21
Raleigh, N. C.	16	262	23	8	..	16	4	1	..	..	..	..	..	52
Rutherfordtown, N. C.	4	103	..	..	..	..	..	..	..	..	..	..	..	..
Camp Seymour, N. C.	1	79	..	..	..	..	..	..	..	..	..	..	..	..
Watertown Arsenal	5	50	5	..	..	2	3	..	..	..	..	..	..	10
Willett's Point, N. Y.	10	353	9	3	..	5	2	11	..	1	..	4	1	36
Yanceyville, N. C.	5	100	4	2	..	2	..	..	..	..	..	..	..	8
Fort McHenry, Md.	17	264	25	2	..	25	4	..	..	..	..	..	..	56
Fort Monroe, Va.	37	391	44	27	..	52	6	6	..	..	..	..	..	135
Fort Niagara, N. Y.	5	56	..	..	..	..	..	..	..	..	..	..	..	..
Fort Ontario, N. Y.	4	53	..	1	..	..	1	..	..	..	..	..	..	2
Fort Porter, Buffalo	19	190	9	..	..	11	..	..	..	..	..	..	..	20
Fort Preble, Me.	6	90	1	1	..	3	2	..	2	..	..	..	..	9
Fort Schuyler, N. Y.	9	125	4	1	..	17	..	..	..	..	..	..	..	22
Fort Sullivan, Me.	4	68	..	..	..	2	2	..	..	..	..	..	..	4
Fort Trumbull, Conn.	6	63	3	1	..	6	..	..	..	..	..	..	..	10
Fort Wadsworth, N. Y.	6	66	1	1	..	3	..	..	..	..	..	1	..	6
Fort Warren, Mass.	15	225	5	4	..	..	7	..	1	..	..	..	..	17
Fort Washington, Md.	8	109	1	1	..	9	..	..	..	..	..	..	..	11
Fort Wayne, Mich.	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Wood, N. Y.	2	98	2	3	2	9	7	1	..	..	..	..	..	24
Totals	339	6,371	258	127	7	308	52	30	4	2	29	7	1	825

1871. (Numerical Strength of Army, 1871-2-3-4.)

Station	Officers.	Men.	Syphilis Primaria.	Syphilis Secunda.	Syph. Iritis.	Syph. Ulcer.	Gonorrhœa.	Gon. Orchitis.	Bubo.	Balanitis.	Epidydimitis.	Chancroids.	Strict. Urethræ.	Venereal Warts.	Total.
Fort Adams, R. I.	13	192	..	..	..	..	12	3	1	..	..	..	..	1	17
Alleghany Arsenal	4	50	3	..	..	..	2	..	..	..	..	..	..	..	5
Fort Columbus, N. Y.	11	797	37	12	..	..	34	8	4	3	..	11	10	..	119
Charleston, W. Va.	3	56	..	..	..	..	..	..	..	..	..	..	..	..	..
Charlotte Station, N. C.	3	57	2	1	..	1	1	..	..	..	..	..	..	..	5
David's Island, N. Y.	36	845	64	39	..	..	36	19	..	..	..	..	7	..	165
Fort Delaware	9	166	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Foote, Md	4	65	10	6	..	..	6	..	..	..	..	..	..	..	22
Camp Foster, Vt.	9	137	..	..	..	..	..	..	..	..	..	..	..	..	..
Frankford Arsenal	4	50	4	..	..	..	3	..	..	..	..	..	..	..	7
Graham, N. C.	3	66	..	..	..	..	..	..	..	..	..	..	..	..	..
Camp Grant, Va.	3	62	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Gratiot, Mich.	4	55	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Hamilton, N. Y.	15	292	36	6	..	..	34	3	..	..	..	..	..	..	79
Fort Independence	7	85	..	6	..	..	6	..	..	..	..	..	..	..	12
Fort Johnston, N. C.	4	111	..	6	..	..	..	2	..	..	..	..	..	..	8
Fort Mackinac, Mich.	4	48	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Macon, N. C.	7	120	12	7	..	..	9	2	..	..	..	..	..	..	30
Indianapolis Arsenal	1	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Kennebec Arsenal	1	22	..	..	..	..	..	..	..	..	..	..	..	..	..
Lumberton, N. C.	3	53	18	2	..	..	1	..	..	..	..	..	..	..	21
Madison Barracks	4	57	..	..	..	..	..	..	..	..	..	..	..	..	..
Naturkit Barracks	6	50	..	..	..	..	..	..	..	..	..	..	..	..	..
Plattsburg Barracks	3	69	..	4	..	..	..	2	..	..	..	..	2	..	8
Sedgwick (D.C.) Bar'ks.	8	224	..	..	..	..	..	..	..	..	..	..	..	..	..
Raleigh, N. C.	16	262	11	6	..	..	3	1	..	..	..	..	..	..	21
Rutherfordtown, N. C.	4	103	12	..	..	..	3	3	..	..	..	..	..	..	18
Camp Seymour, N. C.	1	79	..	..	..	..	2	..	..	..	..	..	..	..	2
Watertown Arsenal	5	50	2	..	..	..	4	..	..	..	..	..	..	..	6
Willett's Point, N. Y.	10	353	33	23	..	..	14	2	2	..	..	4	..	..	78
Yanceyville, N. C.	5	100	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort McHenry, Md.	17	264	12	4	..	..	40	6	..	..	..	..	..	..	62
Fort Monroe, Va.	37	391	9	12	..	..	41	2	4	..	..	..	..	..	68
Fort Niagara, N. Y.	5	56	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Ontario, N. Y.	4	53	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Porter, Buffalo	19	190	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Preble, Me.	6	90	..	..	..	..	3	..	..	..	..	..	..	..	3
Fort Schuyler, N. Y.	9	125	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Sullivan, Me.	4	68	..	..	..	..	1	..	..	..	..	..	..	..	1
Fort Trumbull, Conn.	6	63	..	2	..	..	4	1	..	..	..	..	..	..	7
Fort Wadsworth, N. Y.	6	66	2	5	..	..	3	..	..	..	..	..	..	..	10
Fort Warren, Mass.	15	225	1	3	..	..	4	..	..	..	..	..	..	..	8
Fort Washington, Md.	8	109	4	..	..	..	5	..	..	..	..	..	..	..	9
Fort Wayne, Mich.	11	276	..	..	..	..	..	..	..	..	..	..	..	..	..
Fort Wood, N. Y.	2	98	7	..	..	..	4	6	..	..	..	..	..	..	17
Totals	359	6,765	279	144	1	1	275	60	11	3	..	15	19	1	808

1872.

Station	Syphilis Primaria.	Syphilis Secunda.	Gonorrhœa.	Bubo.	Balanitis.	Venereal Warts.	Gon. Orchitis.	Strict. Urethræ.	Total.
Fort Adams, R. I.	5	2	3	..	1	..	..	..	11
Alleghany Arsenal	2	..	..	..	..	..	..	..	2
Fort Columbus, N. Y.	38	16	49	3	..	..	4	2	112
Charleston, W. Va.	..	..	..	..	..	..	..	..	..
Charlotte Station, N. C.	..	..	..	..	..	..	..	..	..
David's Island, N. Y.	13	3	9	..	..	..	3	2	30
Fort Delaware	..	..	..	..	..	..	..	..	..
Fort Foote, Md	4	..	4	..	..	..	3	..	11
Camp Foster, Vt.	..	..	..	..	..	..	..	..	..
Frankford Arsenal	1	..	..	..	..	..	..	..	1
Graham, N. C.	..	..	..	..	..	..	..	..	..
Camp Grant, Va.	..	..	..	..	..	..	..	..	..
Fort Gratiot, Mich.	..	..	..	..	..	..	..	..	..
Fort Hamilton, N. Y.	71	2	50	..	1	..	7	..	131
Fort Independence	..	..	8	..	..	..	..	1	9
Fort Johnston, N. C.	..	..	..	..	..	..	..	..	..
Fort Mackinac, Mich.	..	..	..	..	..	..	..	..	..
Fort Macon, N. C.	..	..	..	..	..	..	..	..	..
Indianapolis Arsenal	..	..	..	..	..	..	..	..	..
Kennebec Arsenal	..	..	..	..	..	..	..	..	..
Lumberton, N. C.	..	..	..	..	..	..	..	..	..
Madison Barracks	..	..	..	..	..	..	..	..	..
Naturkit Barracks	..	..	..	..	..	..	..	..	..
Plattsburg Barracks	2	..	1	..	..	..	..	..	3
Sedgwick (D.C.) Bar'ks.	..	..	..	..	..	..	..	..	..
Raleigh, N. C.	..	..	..	..	..	..	..	..	..
Rutherfordtown, N. C.	..	..	..	..	..	..	..	..	..
Camp Seymour, N. C.	..	..	..	..	..	..	..	..	..
Watertown Arsenal	1	1	..	..	..	..	..	..	2
Willett's Point, N. Y.	10	7	11	5	..	2	..	..	35
Yanceyville, N. C.	..	..	..	..	..	..	..	..	..
Fort McHenry, Md.	38	9	17	..	..	..	3	2	69
Fort Monroe, Va.	21	7	21	..	1	..	4	..	54
Fort Niagara, N. Y.	..	..	..	..	..	..	..	..	..
Fort Ontario, N. Y.	..	..	..	..	..	..	..	..	..
Fort Porter, Buffalo	..	..	..	..	..	..	..	..	..
Fort Preble, Me.	..	1	2	..	..	..	..	..	3
Fort Schuyler, N. Y.	..	..	..	..	..	..	..	..	..
Fort Sullivan, Me.	..	..	2	..	..	..	..	..	2
Fort Trumbull, Conn.	..	1	1	..	..	..	..	..	2
Fort Wadsworth, N. Y.	..	2	..	..	..	..	..	1	3
Fort Warren, Mass.	..	..	1	..	..	..	..	..	1
Fort Washington, Md.	2	1	2	..	..	..	..	..	5
Fort Wayne, Mich.	..	..	..	..	..	..	..	..	..
Fort Wood, N. Y.	8	1	8	..	..	..	..	..	17
Totals	216	58	188	8	3	2	25	8	503

1873.

Station	Syphilis Primaria.	Syphilis Secunda.	Syph. Iritis.	Gonorrhœa.	Gon. Orchitis.	Bubo.	Balanitis.	Syph. Meningitis.	Venereal Warts.	Strict. Urethræ.	Total.
Fort Adams, R. I.	1	..	2	5	..	..	1	..	1	..	10
Alleghany Arsenal	4	..	..	..	..	..	..	..	..	..	4
Fort Columbus, N. Y.	22	11	..	64	3	6	1	1	..	4	112
Charleston, W. Va.	..	..	..	..	..	..	..	..	..	..	..
Charlotte Station, N. C.	..	..	..	..	..	..	..	..	..	..	..
David's Island, N. Y.	8	2	..	11	7	1	4	..	..	8	41
Fort Delaware	..	..	..	..	..	..	..	..	..	..	..
Fort Foote, Md	12	5	..	2	..	..	..	..	..	..	19
Camp Foster, Vt.	..	..	..	..	..	..	..	..	..	..	..
Frankford Arsenal	..	..	..	..	..	..	..	..	..	..	..
Graham, N. C.	..	..	..	..	..	..	..	..	..	..	..
Camp Grant, Va.	..	..	..	..	..	..	..	..	..	..	..
Fort Gratiot, Mich.	..	..	..	..	..	..	..	..	..	..	..
Fort Hamilton, N. Y.	37	6	..	27	8	..	..	..	..	3	81
Fort Independence	..	..	..	1	..	..	..	..	..	5	6
Fort Johnston, N. C.	..	..	..	..	..	..	..	..	..	..	..
Fort Mackinac, Mich.	..	..	..	..	..	..	..	..	..	..	..
Fort Macon, N. C.	..	..	..	..	..	..	..	..	..	..	..
Indianapolis Arsenal	..	..	..	..	..	..	..	..	..	..	..
Kennebec Arsenal	..	..	..	..	..	..	..	..	..	..	..
Lumberton, N. C.	..	..	..	..	..	..	..	..	..	..	..
Madison Barracks	2	..	..	5	..	..	..	..	..	..	7
Naturkit Barracks	..	..	..	..	..	..	..	..	..	..	..
Plattsburg Barracks	3	4	..	1	..	..	..	..	..	..	8
Sedgwick (D.C.) Bar'ks.	..	..	..	..	..	..	..	..	..	..	..
Raleigh, N. C.	..	..	..	..	..	..	..	..	..	..	..
Rutherfordtown, N. C.	..	..	..	..	..	..	..	..	..	..	..
Camp Seymour, N. C.	..	..	..	..	..	..	..	..	..	..	..
Watertown Arsenal	..	..	..	..	..	..	..	..	..	..	..
Willett's Point, N. Y.	7	5	..	11	1	..	..	..	..	..	24
Yanceyville, N. C.	..	..	..	..	..	..	..	..	..	..	..
Fort McHenry, Md.	42	12	..	9	5	..	..	..	..	3	71
Fort Monroe, Va.	11	6	..	6	3	1	..	..	..	1	28
Fort Niagara, N. Y.	1	..	..	..	..	..	..	..	..	..	1
Fort Ontario, N. Y.	..	..	..	..	..	..	..	..	..	..	..
Fort Porter, Buffalo	..	4	..	..	..	..	..	..	..	..	4
Fort Preble, Me.	..	..	..	..	..	..	..	..	..	..	..
Fort Schuyler, N. Y.	..	..	..	..	..	..	..	..	..	..	..
Fort Sullivan, Me.	5	..	..	..	..	..	..	..	..	..	5
Fort Trumbull, Conn.	..	..	..	..	..	..	..	..	..	..	..
Fort Wadsworth, N. Y.	1	2	..	1	..	..	..	..	..	9	13
Fort Warren, Mass.	4	..	..	1	..	..	..	..	..	..	5
Fort Washington, Md.	..	..	..	..	..	..	..	..	..	..	..
Fort Wayne, Mich.	..	..	..	..	..	..	..	..	..	..	..
Fort Wood, N. Y.	..	3	..	..	2	..	..	..	..	..	5
Totals	160	60	2	142	31	8	6	1	1	33	444

1874.

Station	Syphilis Primaria.	Syphilis Secunda.	Gonorrhœa.	Gon. Orchitis.	Bubo.	Balanitis.	Chancroids.	Strict. Urethræ.	Total.
Fort Adams, R. I.	2	6	2	2	..	..	..	..	12
Alleghany Arsenal	..	1	..	..	..	..	..	..	1
Fort Columbus, N. Y.	13	21	46	5	..	1	..	4	90
Charleston, W. Va.	..	..	..	..	..	..	..	..	..
Charlotte Station, N. C.	..	..	..	..	..	..	..	..	..
David's Island, N. Y.	5	..	3	..	..	..	..	..	8
Fort Delaware	..	..	..	..	..	..	..	..	..
Fort Foote, Md	6	3	1	..	..	..	..	..	10
Camp Foster, Vt.	..	..	..	..	..	..	..	..	..
Frankford Arsenal	..	..	..	..	..	..	..	..	..
Graham, N. C.	..	..	..	..	..	..	..	..	..
Camp Grant, Va.	..	..	..	..	..	..	..	..	..
Fort Gratiot, Mich.	5	1	2	..	..	..	..	..	8
Fort Hamilton, N. Y.	6	3	17	1	7	..	..	2	36
Fort Independence	..	..	..	..	..	..	..	..	..
Fort Johnston, N. C.	..	..	..	..	..	..	..	..	..
Fort Mackinac, Mich.	..	1	..	..	..	..	1	..	2
Fort Macon, N. C.	..	..	..	..	..	..	..	..	..
Indianapolis Arsenal	1	..	..	..	..	..	..	..	1
Kennebec Arsenal	..	..	..	..	..	..	..	..	..
Lumberton, N. C.	..	..	..	..	..	..	..	..	..
Madison Barracks	6	..	11	1	..	..	..	..	18
Naturkit Barracks	..	..	..	..	..	..	..	..	..
Plattsburg Barracks	..	..	..	..	..	..	..	..	..
Sedgwick (D.C.) Bar'ks.	..	..	..	..	..	..	..	..	..
Raleigh, N. C.	..	..	..	..	..	..	..	..	..
Rutherfordtown, N. C.	..	..	..	..	..	..	..	..	..
Camp Seymour, N. C.	..	..	..	..	..	..	..	..	..
Watertown Arsenal	..	4	..	..	..	..	..	..	4
Willett's Point, N. Y.	11	11	10	..	..	1	..	..	33
Yanceyville, N. C.	..	..	..	..	..	..	..	..	..
Fort McHenry, Md.	18	12	5	6	..	..	..	..	41
Fort Monroe, Va.	9	4	22	..	..	..	..	..	35
Fort Niagara, N. Y.	..	4	..	..	..	..	..	..	4
Fort Ontario, N. Y.	..	..	1	..	..	..	..	..	1
Fort Porter, Buffalo	..	..	2	2	..	..	..	..	4
Fort Preble, Me.	3	..	..	..	..	..	..	..	3
Fort Schuyler, N. Y.	..	..	..	..	..	..	..	..	..
Fort Sullivan, Me.	..	..	..	..	..	..	..	..	..
Fort Trumbull, Conn.	..	..	..	..	..	..	..	..	..
Fort Wadsworth, N. Y.	4	6	1	..	..	..	..	..	11
Fort Warren, Mass.	4	4	1	..	..	..	..	..	9
Fort Washington, Md.	..	..	..	..	..	..	..	..	..
Fort Wayne, Mich.	2	2	3	..	..	..	..	..	7
Fort Wood, N. Y.	..	2	4	..	..	..	..	..	6
Totals	97	83	128	20	7	2	1	6	344

[A. *Continued.*] *Number of Men discharged from the Service in the Army of the East for Venereal Affections.*

Years.	No. of Men.
1870	9
1871	9
1872	7
1873	15
1874	5
Total	45

SUMMARY.

Total aggregate strength of Army of the East, from January, 1870, to September, 1874, inclusive	35,206
Total number of venereal	2,920
Total number of syphilis	1,488
Percentage of venereal to total strength	8.29
Percentage of syphilis to total strength	4.22
Percentage of syphilis to venereal	50.95
Number discharged from the service for venereal diseases, from 1870 to 1874, inclusive	45

[B.] *Returns of Mercantile Marine in the Port and State of New York, as to Venereal and Syphilitic Affections amongst Seamen, taken from Records of Marine Hospital, from January*, 1871, *to October*, 1874.

Name of Hospital or other Institution, and Date.	Total number of Patients on Books.	Syphilis Primaria.	Syphilis Secundaria.	Syph. Rheumatism.	Syph. Ulcers.	Syph. Orchitis.	Bubos.	Gonorrhœa and Gleet.	Chancroids.	Strict. Urethræ.	Balanitis and Epidydimitis.	Ophthalmia, Gonorrhœa.	Amputation of Penis.	Venereal Warts and Growths.	Total Venereal Diseases.	Balance for other Diseases.
Brooklyn City Hospital: —																
January to August, 1871	690	28	18	7	4	6	31	47	44	12	15	..	..	5	217	473
September to December, 1872	210	14	9	..	..	1	1	1	..	2	..	1	..	..	29	181
January to December, 1873	389	32	30	..	..	4	2	5	..	7	..	..	..	..	80	309
January to October, 1874	633	53	63	1	..	21	..	10	..	9	1	..	..	..	158	475
Bellevue: —																
1871	368	27	5	2	..	10	1	2	..	10	..	..	..	..	57	311
1872	215	12	..	..	..	1	3	3	..	3	..	..	..	..	22	193
Seaman's Retreat:																
August to December, 1871	284	25	9	..	..	4	2	3	..	1	..	..	..	..	44	240
January to December, 1872	705	90	34	..	..	21	7	14	..	9	..	1	..	..	176	529
January to December, 1873	627	82	44	..	..	22	9	22	..	11	..	..	..	..	190	437
January to October, 1874	510	18	21	..	..	3	..	8	..	6	..	..	..	..	56	454
Long Island College Hospital: —																
January to December, 1872	361	39	22	2	..	15	..	35	16	7	12	..	..	1	149	212
January to December, 1873	199	15	10	..	..	3	..	..	1	4	..	..	..	..	33	166
January to October, 1874	546	34	44	1	..	5	..	7	..	6	..	..	..	..	97	449
Jersey City Charity: —																
July, 1872, to date	34	4	13	..	..	..	..	..	..	..	..	..	..	..	17	17
Office Book: —																
November, 1873, to October, 1874	504	21	38	15	8	6	10	101	..	1	6	..	1	..	207	297
Grand Total of Patients.	6275	494	360	28	12	122	66	258	61	88	34	2	1	6	1532	4743

Percentage of venereal to total	24.34
Percentage of syphilis to total	16.19
Percentage of syphilis to venereal	66.31

[B. *Continued.*] *Records of Mercantile Marine for the U. S. A. for the years* 1872 *and* 1873. *Maine to Alaska.*

Years.	Total number of Patients.	Syphilis Primaria.	Syphilis Secundaria.	Syph. Rheumatism.	Syph. Ulcers.	Syph. Orchitis.	Syph. Iritis.	Gonorrhœa and Gleet.	Bubos.	Strictura Urethræ.	Balanitis and Epi-dydimitis.	Gonorrhœa, Oph-thalmia.	Total Venereal Dis-eases.	Balance for other Diseases.
1872	11,948	1070	630	25	..	115	6	29	16	101	61	3	2056	9,892
1873	12,697	902	900	..	17	112	2	47	2	124	4	4	2114	10,583

Total number of cases under treatment during 1872 and 1873 .	24,645
Total number of venereal	4,170
Total number of syphilis	3,779
Percentage of venereal to total	16.92
Percentage of syphilis to total	15.33
Percentage of syphilis to venereal	90.38

[*Note continued from page* 450.]

E. In Relation to its Influence on Deformity:

1. Deformity of the face.
2. Deformities of other parts of the body (the fingers, toes, etc.).

F. In Relation to Fitness for Military Service:

1. Cases of release from time on account of incapacity resulting from syphilis.
2. Cases of exclusion from the service on account of incapacities resulting from syphilis.

The Collection of the Data on Syphilis is Obligatory in:

1. Hospitals, ambulances, lying-in hospitals, foundling hospitals, asylums for infants and nurses, and houses of detention.

2. Among land and sea forces; these corps should be regularly inspected as they are in Russia.

3. In sanitary bureaux, and places of inspection of prostitutes.

4. It would in addition be desirable if medical officers attached to manufactories, and inspectors of large collections of men, or those who have the medical supervision of great bodies of people, would collect facts bearing on this question.

"The detail in which the statistical data connected with syphilis can be gathered in any country, depends upon the proportion of medical men to the mass of population in that country; but it is to be regretted that even in countries well provided in this respect, central points have not been fixed where these facts can be centralized.

This circumstance is so prejudicial to the uniformity of the materials already collected as to render it nearly impossible to work them into a harmonious whole. The natural centres for the collection of these data should be, in our opinion, the medical administrations (sanitary bureaux), if they have statistical sections, or central statistical offices. Unhappily the medical administrations of all countries do not embrace the extended study of syphilis in their operations, but restrict their action to a somewhat defective study of syphilis *propagated by prostitution.**

* *Medical Statistics with especial reference to Cholera and Syphilis.* F. J. Monat, M. D., M. R. C. S. *Trans. of the Epidemiological Society of London*, Sessions of 1869 to 1873, vol. iii., Part II.

[C.] *Statistics of British Army in the United Kingdom and Colonies, in Relation to Venereal Affections.*

Extracted and Tabulated from Medical Reports of British Army, 1869–1871.

1869.

	Strength of Army.	Total Troops in Hospital with Venereal Diseases.	Syphilis Primaria.	Syphilis Secunda.	Gon. Rheumatism.	Gonorrhœa.	Bubo.	Strict. Urethræ.	Gon. Epidydimitis.	Invalided.	Died.	Discharged.
United Kingdom	68,962	9,787	5,433	1,952	11	1,613	197	217	264	..	..	..
In the Mediterranean — Gibraltar, Malta, and Ionian Islands	10,207	1,008	333	147	1	422	64	28	13	25	..	..
In Canada, Bermuda, etc.	11,137	1,490	505	193	1	662	88	22	20	12	..	..
In Windward and Leeward Command, and Jamaica	1,709	208	108	28	..	135	10	4	3	2	..	..
Colored Troops in Jamaica, Honduras, Bahamas, etc.	4,480	546	276	37	..	206	15	8	4	..	..	..
Colored Troops in West Africa	824	221	119	15	..	78	6	2	1	..	..	..
Cape of Good Hope, Straits, etc.	7,426	2,057	566	331	3	985	102	30	40	..	..	..
Australia, New Zealand, China, and Japan	3,917	819	232	140	..	400	31	14	2	..	..	..
Madras, Bombay, etc.	76,803	4,187	1,542	852	12	1,425	220	78	58	62	..	..

1870.

	Strength of Army.	Total Troops in Hospital with Venereal Diseases.	Syphilis Primaria.	Syphilis Secunda.	Balanitis.	Gon. Ophthalmia.	Gon. Rheumatism.	Gon. Epidydimitis.	Gonorrhœa.	Bubo.	Strict. Urethræ.	Invalided.	Died.	Discharged.
United Kingdom	68,131	13,797	4,808	1,969	..	..	6	247	6,484	121	162	144	7	..
In the Mediterranean — Gibraltar, Malta, and Ionian Islands	9,704	757	214	92	..	..	..	19	387	27	18	20	..	5
In Canada, Bermuda, etc.	6,427	860	313	102	..	..	..	20	409	7	9	7	..	7
In Windward and Leeward Command, and Jamaica	1,432	184	65	14	..	..	..	5	91	9	...	2	..	2
Colored Troops in Jamaica, Honduras, Bahamas, etc.	3,152	320	137	34	..	3	..	1	138	5	2	2	4	2
Colored Troops in West Africa	438	123	45	11	..	..	..	...	61	5	1	...	..	..
Cape of Good Hope, Straits, etc.	5,496	1,450	477	133	..	..	1	19	769	29	22	...	1	..
Australia, New Zealand, China, and Japan	2,587	614	159	91	2	..	..	6	315	30	11	2	..	..
Madras, Bombay, etc.	......	......	......	......	..	..	..	...	......	...	...	...	..	..

1871.

	Strength of Army.	Total Troops in Hospital with Venereal Diseases.	Syphilis Primaria.	Syphilis Secunda.	Gon. Ophthalmia.	Gon. Rheumatism.	Gon. Epidydimitis.	Gonorrhœa.	Bubo.	Strict. Urethræ.	Invalided.	Died.	Discharged.
United Kingdom	77,142	16,794	5,183	1,76	..	7	316	9,183	151	183	92	9	..
In the Mediterranean — Gibraltar, Malta, and Ionian Islands	9,968	802	147	69	..	..	18	543	8	19	3	7	7
In Canada, Bermuda, etc.	4,116	463	136	97	..	3	14	192	13	8	7	..	4
In Windward and Leeward Command, and Jamaica	966	205	41	14	..	..	1	143	5	1	..	..	..
Colored Troops in Jamaica, Honduras, Bahamas, etc.	1,516	491	164	40	1	..	4	263	14	5	..	1	..
Colored Troops in West Africa	2,318	70	18	7	..	1	1	42	...	1	..	..	..
Cape of Good Hope, Straits, etc.	4,836	1,079	372	112	..	2	16	561	1	15	4	1	4
Australia, New Zealand, China, and Japan	4,527	548	109	100	..	..	13	206	11	9	9	2	4
Madras, Bombay, etc.	......	......	......	......	..	..	...	......	...	...	..	..	..

[C.] SUMMARY.

1869–1871.

Total aggregate strength of Army, 1869–71	388,221
Total number of venereal sick	58,960
Total number of syphilitic patients	29,851
Total number invalided	393
Total number died	32
Total number discharged	35
Percentage of venereal to total	8.29
Percentage of syphilis to total	4.22
Percentage of syphilis to venereal	50.95
Percentage of deaths to total of syphilitic cases	$\frac{1}{10}$th.

[D.] *Statistics of Syphilis in the U. S. Army, from* 1840 *to* 1859 *inclusive, a Period of Twenty Years, with Deaths due to that Cause.*

Years.	Strength of Army.	Cases of Syphilis.	Deaths.
1840–1854	120,622	1,163	11
1855	9,367	94	0
1856	14,434	133	1
1857	12,701	145	0
1858	14,510	289	0
1859	15,510	345	1

Aggregate strength of Army (20 years, from 1840 to 1859)	187,144
Number of cases	2,169
Deaths	13
Percentage of deaths to total of cases	.6
Percentage of syphilis to aggregate strength of Army	1.1

[E.] *Returns of the Patients treated in the Naval Hospital, Brooklyn, for Venereal Diseases, from* 1870 *to* 1874.

Name of Affection.	1870	1871	1872	1873	1874	Total.
Syphilis primaria	3	6	6	9	3	27
Syphilis secundaria	14	19	13	17	21	84
Orchitis	2	3	3	6	8	22
Bubo	–	–	1	2	–	3
Gonorrhœa	7	–	1	6	3	17
Strict. Urethræ	1	7	4	4	5	21
Syph. ulcers	–	4	5	3	5	17
Syph. iritis	–	–	–	2	1	3
Syph. rheumatism	–	–	–	2	3	5
Total	27	39	33	51	49	199

[E. *Continued.*]

	Total Number of Patients in Hospital.	Venereal.
1870	254	27
1871	301	39
1872	225	33
1873	235	51
1874	370	49
	1,385	199

Percentage of venereal to total patients 14.36
Percentage of syphilis to total patients 8.59
Percentage of syphilis to venereal 59.79

[F.] *Total Number of Patients treated at the Public Hospitals of New York City, for the Year* 1873.

1. Bellevue	6,187
2. Charity	9,871
3. Small-pox	505
4. Fever	125
5. Incurables	220
6. Epileptic and Paralytics	215
7. Infants	1,291
8. Nursery	738
9. Idiot and Epileptic	212
10. Convalescent	1,499
11. Reception (No. 1.)	3,995
12. Reception (No. 2.)	387
13. State Emigrant	7,852
14. St. Luke	928
15. St. Vincent	952
16. St. Francis	1,564
17. German	609
18. Mount Sinai	874
19. Woman's Hospital	346
20. Nursery and Children's (City and County branches)	663
21. St. Mary's Hospital for Children	77
22. St. Elizabeth	280
Total	39,390

Total Number of Patients treated at the Public Dispensaries of New York City during the Year 1873.

1. Reception Hospital (out-door department)	1,722
2. Mount Sinai Hospital (out-door department)	1,792
3. Woman's Hospital (out-door department)	616
4. New York	26,491
5. Northern	12,513
6. Eastern	20,116
7. Demilt	22,330
8. Northwestern	10,753
9. German	12,879
10. Northeastern	15,849
11. Out-door Relief Bureau, Bellevue Hospital	71,744
12. Harlem	3,527
13. Yorkville	3,184
14. Central	5,206
15. Holy Trinity	2,437
16. Western Dispensary, Women and Children	1,645
17. New York Dispensary for Sick Children	2,672
18. West-side, German	3,585
Total	219,061

[F. *Continued.*] *Total Number of Patients treated at the Special Hospitals and Dispensaries of New York City, for* 1873.

1. New York Ear Dispensary	641
2. Orthopœdic Dispensary and Hospital	424
3. Dental Infirmary	5,941
4. Hospital for Ruptured and Crippled	4,023
5. New York Ear Infirmary	8,756
6. Manhattan Eye and Ear Hospital	2,300
	22,085

Total poor persons receiving medical aid at the hospitals and dispensaries of New York City during the year 1873 280,536

Total Venereal Poor in New York City receiving medical aid at public institutions on the estimate based upon Appendix H 12,341

Total Syphilitic Poor in New York City, receiving medical aid at public institutions, on the estimate based upon Appendix H 5,045

[G.] *Summary compiled from Mr. Wagstaff's Report to the Medical Officer of the Privy Council, on the Amount and Kinds of Venereal Disease under Treatment at certain Charitable Institutions in London.*

The undermentioned departments of the several hospitals and dispensaries were taken, namely: —

Surgical Out-Patient,
Medical Out-Patient,
Ophthalmic,
Women and Children,
Surgical Casual,
Medical Casual,
Skin Diseases.

The diseases taken were Gonorrhœa, Simple Chancre, and Syphilis (both acquired and hereditary).

HOSPITALS. — AUGUST, 1868.

Name.	Number of Patients.	Venereal Cases.		Syphilitic Cases.		
		Number.	Per cent. of Total.	Number.	Per cent. of Total.	Per cent. of Venereal.
St. Bartholomew's . . (1 week's statistics.)	3,611	294	8.14	127	3.51	43.19
St. Thomas's . . . (1 week's statistics.)	2,101	149	7.09	78	3.71	52.34
St. George's . . . . (1 week's statistics.)	1,015	74	7.29	47	4.63	63.51
Royal Free . . . . (4 days' statistics.)	1,490	256	17.18	118	7.92	46.09

[G. *Continued.*] DISPENSARIES.—AUGUST, 1868.

Name.	Number of Patients.	Venereal Cases.		Syphilitic Cases.		
		Number.	Per cent. of Total.	Number.	Per cent. of Total.	Per cent. of Venereal.
Western General . . (2 days' statistics.)	340	17	5.00	12	3.50	70.58
Finsbury . . . . . (3 days' statistics.)	221	4	1.81	4	1.81	100.00
Farringdon . . . . (3 days' statistics.)	192	15	7.80	6	3.12	40.00
Surrey . . . . . . (2 days' statistics.)	320	3	.94	2	.62	66.66
Stanhope Street . . (2 days' statistics.)	64	4	6.25	1	1.56	25.00

In-Patients of the following Hospitals and Workhouses—the Number of Venereal and the Number of Syphilitic—Time of observation, one day.

Name.	Number of Patients.	Venereal Cases.		Syphilitic Cases.		
		Number.	Per cent. of Total.	Number.	Per cent. of Total.	Per cent. of Venereal.
St. George's . . . . (Hospital.)	308	26	8.44	23	7.46	88.46
London . . . . . . (Hospital.)	477	23	4.82	21	4.40	91.30
Royal Free . . . . (Hospital).	81	23	28.39	14	17.28	60.87
Lambeth . . . . . (Workhouse.)	315	8	2.53	8	2.53	100.00
St. Pancras . . . . (Workhouse.)	132	14	10.60	4	3.03	28.57

SUMMARY.

Institutions.	Number of Patients.	Venereal.	Syphilitic.
Total Out-Patients, Hospitals and Dispensaries .	9,354	816	395
Total In-Patients, Hospitals and Workhouses . .	1,313	94	70
Total Parochial Out-Patients (one week) . . .	2,475	0	0
Total	13,142	910 or 6.92 per cent. of Total.	465 or 3.53 per cent. of Total. 51 per cent. of Venereal.

[H.] *Return of Patients, treated for Venereal Diseases, January and August,* 1873.

	GONORRHŒA. Jan'y. Males.	Females.	Children.	Aug. Males.	Females.	Children.	Grand Total.	CHANCROID. Jan'y. Males.	Females.	Children.	Aug. Males.	Females.	Children.	Grand Total.
NEW YORK CITY.														
Eastern Dispensary	6	..	..	5	3	..	14	1	1	1	4	2	..	9
Demilt Dispensary	10	2	..	11	5	..	28	6	3	..	4	4	..	17
Northwestern Dispensary	10	4	..	5	1	..	20	3	2	..	2	1	..	8
Northeastern Dispensary	4	3	..	3	4	..	14	4	2	..	4	3	..	13
Central Dispensary	1	..	..	3	1	..	5	..	..	..	1	2	..	3
German Dispensary.*	18	..	..	24	..	..	42	9	..	..	7	..	..	16
New York Dispensary	74	6	..	69	8	..	157	23	4	..	30	9	..	66
Bellevue Hospital	26	4	..	18	3	..	51	15	5	..	17	5	..	42
Charity Hospital (B. I.)	34	4	..	20	3	..	61	49	27	..	21	21	..	118
German Hospital	6	..	..	3	..	..	9	1	..	..	1	..	..	2
Nursery Hospital (Randall's Island, New York.)	..	..	..	..	..	..	....	..	..	..	..	..	..	....

	SYPHILIS, ACQUIRED. Jan'y. Males.	Females.	Children.	Aug. Males.	Females.	Children.	Grand Total.	SYPHILIS, HEREDITARY. Jan'y. Males.	Females.	Children.	Aug. Males.	Females.	Children.	Grand Total.
NEW YORK CITY.														
Eastern Dispensary	1	1	..	6	5	..	13	1	3	2	3	2	2	13
Demilt Dispensary	5	4	..	5	2	2	18	9	3	2	6	5	5	30
Northwestern Dispensary	4	4	3	5	3	3	22	4	4	2	3	3	1	17
Northeastern Dispensary	2	1	4	3	3	4	17	6	4	5	4	3	3	25
Central Dispensary	..	5	1	3	2	2	13	..	..	..	..	1	..	1
German Dispensary.*	28	..	..	32	..	..	60	..	..	1	..	..	3	4
New York Dispensary	30	17	..	36	18	..	101	..	1	..	..	1	..	2
Bellevue Hospital	11	13	7	20	22	7	80	7	3	5	10	3	8	36
Charity Hospital (B. I.)	24	18	1	22	10	2	77	9	6	1	14	5	1	36
German Hospital	1	1	..	4	..	..	6	1	1	..	2	..	..	4
Nursery Hospital (Randall's Island, New York.)	..	..	8	..	..	5	13	..	..	4	..	..	3	7†

	BALANITIS, SWOLLEN TESTES, ETC. Jan'y. Males.	Females.	Children.	Aug. Males.	Females.	Children.	Grand Total.	TOTAL VENEREAL DISEASES. Males.	Females.	Children.	Grand Total.	Total Number of all Classes treated during the Two Months.	PERCENTAGES OF Venereal Patients to Total Number of Cases.	Syphilitic Patients to Total Number of Cases.	Syphilitic Patients to Venereal Patients.
NEW YORK CITY.															
Eastern Dispensary	..	..	..	2	..	..	2	29	17	5	51	3,958	1.30	.60	50.
Demilt Dispensary	..	..	..	..	..	..	....	56	28	9	93	3,722	250	1.20	5.00
Northwestern Dispensary	2	1	..	..	..	..	3	38	23	9	70	1,947	3.50	2.00	55.00
Northeastern Dispensary	2	1	..	..	..	..	3	32	24	16	72	2,798	2.50	1.50	58.30
Central Dispensary	1	..	..	..	..	..	1	9	11	3	23	835	2.70	1.60	61.00
German Dispensary.*	10	..	..	12	..	..	22	140	....	4	144	1,020	14.00	6.30	44.00
New York Dispensary	26	..	..	24	..	..	50	312	64	....	376	4,506	8.30	2.30	27.00
Bellevue Hospital	7	5	..	7	5	..	24	138	68	27	233	11,392	2.40	1.00	50.00
Charity Hospital (B. I.)	23	12	..	22	6	..	63	238	112	5	355	1,546	23.00	7.00	32.00
German Hospital	..	..	..	..	..	..	....	19	2	....	21	99	21.00	10.00	48.00
Nursery Hospital (Randall's Island, New York.)	..	..	..	..	..	..	....	....	....	20	20	726‡	....	....	2.70

Summary.

	No. of Cases.
Total number of Patients (as above)	32,549
Total number of Venereal Patients	1,458
Total number of Syphilitic Patients	595

	Percentages.
Venereal to total number of Patients treated	44.00
Syphilitic to total number of Patients treated	1.80
Syphilitic to Venereal Patients treated	41.00

* In the Return of the German Dispensary, given above, the figures in the column headed "Males" includes also the Females.
† Two of these cases were treated in the Infant Hospital on the same Island.
‡ Number of Children in Hospital.

[K.] *Syphilitic Patients treated at the Hospitals of Paris, France, during the years* 1867 *and* 1868.[1]

In 1867 and 1868, the hospitals of Du Midi and Lourcine received the following patients: —

Du Midi, in 1867	3,226
" " " 1868	3,185
Lourcine, in 1867	1,030
" " 1868	1,024

During the same year, secondary syphilitic affections have been treated in the general hospitals in the following numbers: —

	1867	1868
Hôtel Dieu	134	136
Pitié	114	90
Charité	152	138
Saint Antoine	94	141
Necker	21	50
Cochin	5	6
Beaujon	98	95
Lariboisière	89	105
Saint Louis	562	676
Enfants Malades	3	4
Sainte Eugénie	7	6
Maison d'Accouchement	–	3
Cliniques	10	12
Maison Municipale de Santé	73	68
Enfants Assistés	41	21
Total	1,403	1,551

The number of venereal patients treated at the Hospital of St. Lazare was, —

In 1867	1,357
In 1868	1,694

As regards soldiers thus afflicted, their number in 1868, divided among the various military hospitals, was as follows: —

Val de Grace	820
Gros Caillon	331
Saint Martin	385
Vincennes	371
	1,907

[1] J. C. LECOUR, *La Prostitution à Paris et à Londres.* Paris, 1872, pp. 86, 87.

Add to these figures the number forwarded in 1868 to Paris from the Military Hospital in the department of Seine et Oise, say 435, and we have, —

Grand total Venereal Patients treated in Paris during 1868 at hospitals, 9,796.

The population of Paris in 1870 was estimated at 2,000,000 persons. This would give the *percentage* of syphilis treated at hospitals to total population, as a little over $\frac{4}{10}$ of one per cent.

[L.] *Statistics of Deaths from Syphilis in English and American Hospitals (London and New York).*

Hospital.	Year.	Number of Cases.	Cured and Relieved.	Unrelieved.	Died.	Discharged for other than Medical Reasons.	Remaining in Hospital.	Percentage of Deaths to whole Number of Cases.
St. Thomas's . .	1866	29	25	2	2	–	–	
	1867	6	4	–	2	–	–	
	1868	11	7	4	–	–	–	
	1869	29	26	3	–	–	–	
	1870	18	15	2	1	–	–	
	1871	37	33	3	1	–	–	
Totals . .		130	110	14	6	–	–	4.61
St. Bartholomew's.	1862 to 1864 inclusive.	900	894	–	6	–	–	
	1865	249	203	5	2	39	–	
	1866	257	220	5	1	31	–	
	1867	220	192	–	4	24	–	
	1868		(No rec	ord.)				
	1869	186	156	–	2	–	28	
	1870	261	224	4	7	–	26	
	1871	219	203	2	1	–	13	
Totals . .		2,292	2,092	16	23	94	67	1.04
London	1863	41	37	–	3	–	1	
	1864	124	102	1	3	4	14	
	1865	44	39	4	1	–	–	
Totals . .		209	178	5	7	4	15	3.34
St. George's . .	1866	59	Not given.	Not given.	1	Not given.	Not given.	
	1867	53			1			
	1868	59			1			
	1869	57			1			
	1870	59			1			
Totals . .		287	–	–	5	–	–	1.74

[L. *Continued.*]

Hospital.	Year.	Number of Cases.	Cured and Relieved.	Unrelieved.	Died.	Discharged for other than Medical Reasons.	Remaining in Hospital.	Percentage of Deaths to whole Number of Cases.
N. Y. Penitentiary. Blackwell's Island.	1854	1,253	1,244	7	2	–	–	
	1855	1,316	1,314	–	2	–	–	
	1856	1,389	1,384	–	5	–	–	
	1857	1,710	1,704	–	5	–	–	
Totals . . .	–	5,668	5,646	7	14	–	–	.24

SUMMARY.

Total Number of Cases	8,586
Total Number of Deaths	55
Percentage of Deaths to Total Number of Cases	.64

[M.] *Total Number of Syphilitic Children at the Moscow Hospital, Russia, from* 1860 *to* 1870 *inclusive, with Deaths from that Cause.*[1]

Years.	Number of Children.	Deaths.	Percentage.
1860	224	148	66
1861	204	150	75
1862	140	93	67
1863	150	123	82
1864	198	139	70
1865	171	131	70
1866	165	124	70
1867	174	131	69
1868	208	152	73
1869	184	116	63
1870	184	118	65

[1] *Gunzburg. Oesterreich. Jahrb. für Pædiatrik*, Jahrg. 1872. Bd. ii.

[N.] *Statistics of Sixty-one Births of Syphilitic Children, in Sigmund's Ward, Vienna, Austria. Collated by Dr. F. J. Pick, Wiener.*

Mothers.					Children.
No.	Age and Social Condition.	Duration of Disease before Confinement.	Form of Disease.	Mercurial Treatment.	Condition and Results.
1.	24 years. Working woman.	4 months.	Papulæ in facie interna femorum. Periostitis in fronte.	With.	Seven months' living child, which died 35 days after birth.
2.	25 years. Domestic.	7 months.	Papulæ circa genitalia.	Without.	Dead girl; macerated; premature.
3.	22 years. Servant	4 months.	Papulæ et maculæ per totum corpus.	With.	Living girl, full time, which died in 17 days. (*Debilitas.*
	30 years. Servant.	3 months.	Papulæ ad genitalia.	Without.	Macerated boy, full term. Placenta fatty.
5.	25 years. Servant.	5 months.	Papulæ per totum corpus dispersæ. Angina tonsillaris.	With.	Boy, full time. Died in three months. (*Tabes.*)
6.	25 years. Working woman.	3 months.	Papulæ dispersæ.	Without.	Living girl, full time. Died in three days. (*Debilitas.*)
7.	23 years. Working woman.	2 months.	Papulæ dispersæ.	Without.	Premature birth of dead, macerated boy.
8.	32 years. Charwoman.	3 months.	Papulæ coacervatæ ulcerata in labies et plicés femorab.	Without.	Premature living girl with pemphigus. Died one hour after birth. Œdema of placenta.
9.	24 years. Servant.	4 months.	Papulæ ad anum. (Blennorrhœa vaginæ.)	Without.	Living girl, full term. Blennorrhœa ocul. utriusque neanotorum. Died 20 days after birth. (*Debilitas.*)
10.	20 years. Working woman.	3 months.	Ulcera cum basi dura ad genitalia. Maculæ dispers.	Without.	7 months' child, which lived 5 days. Placenta fatty.
11.	23 years. Silkweaver.	6 weeks.	Papulæ coacervatæ ad anum.	Without.	Living boy, at term. Left the hospital after 3 months.
12.	20 years. Servant.	?	Papulæ ad genitalia.	Without.	Living girl, at term. Died 5 days after birth.
13.	23 years. Working woman.	2 months.	Papulæ circa genitalia.	Without.	Living girl at term. Died in 17 days.
14.	27 years. Servant.	3 months.	Papulæ circa genitalia.	Without.	Boy at full term. Adopted.
15.	23 years. Servant.	6 months.	Papulæ confluentés, circa anum.	Without.	Living girl, at term, which died in 83 days. (*Tabes.*)
16.	22 years. Servant.	9 months.	Papulæ obsoletæ in pontæ.	Without.	Living girl at term. Died 16 days later (*Diarrhœa.*)
17.	24 years. Servant.	3 months.	Papulæ ad anum et circa genit.	Without.	Living girl, at term. Died 13 days later. (*Diarrhœa.*)
18.	22 years. Servant.	3 months.	Maculæ per totum corpus dispersæ.	Without.	Girl, born full term. Died 42 days later. (*Pneumonia.*)
19.	28 years. Servant.	4 months.	Papulæ circa genitalia.	Without.	Living girl, full term.
20.	16 years. Charwoman.	2 months.	Papulæ ad genitalia.	Without.	Living girl, full term. Died 43 days after.
21.	28 years. Servant.	6 months.	Papulæ per totum corpus dispersæ.	Without.	Boy, full term. Died 12 days after.
22.	20 years. Servant.	6 months.	Maculæ dispersæ. Papulæ ad genit. Pustulæ in collo.	Without.	Boy, full term. Died 20 days after.
23.	23 years. Workingwoman.	4 months.	Maculæ dispersæ.	Without.	Abortion.
24.	32 years. Charwoman.	5 months.	Papulæ in angulis oris. Psoriasis.	Without.	Living girl, full term. Died 40 days after.
25.	24 years. Servant.	4 months.	Maculæ in trunco. Papulæ ad genit. et in tonsillis.	Without.	Premature birth of a macerated girl.
26.	28 years. Servant.	5 months.	Papulæ per totum corpus dispersæ.	Without.	Living girl, at full term.
27.	28 years. Servant.	6 months.	Maculæ dispersæ. Papulæ ad genit.	With.	Dead boy, macerated, at full term. Fatty placenta.
28.	20 years. Servant.	2 months.	Papulæ ad genit. Maculæ dispersæ.	Without.	Living boy, full term. Adopted.
29.	19 years. Workingwoman.	2 months.	Papulæ ad genitalia.	Without.	Girl, living, but in the last stage of emaciation. Lived 1 day.
30.	29 years. Servant.		Maculæ dispersæ.	Without.	Living girl, at full term. Died 22 days after. (*Debilitas.*)
31.	26 years. Servant.	5 months.	Papulæ per totam cutem dispersæ.	Without.	Living boy. Rhagades ad anum. Died 38 days after.

[N. *Continued.*]

Mothers.					Children.
No.	Age and Social Condition.	Duration of Disease before Confinement.	Form of Disease.	Mercurial Treatment.	Condition and Results.
32.	23 years. Servant.	4 months.	Papulæ ad genitalia.	Without.	Eight months' child, which died in 12 days.
33.	20 years. Workingwoman.	4 months.	Psoriasis plantaris.	Without.	Premature birth, girl, which died in one day.
34.	26 years. Workingwoman.	2 months.	Papulæ dispersæ.	Without.	Premature birth, dead boy. Torsion of the cord.
35.	23 years. Servant.	3 months.	Maculæ et papulæ per totum corpus dispersæ. (Blennorrhœa vaginæ.)	Without.	Girl, at full term, with blennorhœa oc. utr. neau. in 11 days. Roseola. Child died in 75 days, of *Tabes*.
36.	22 years. Servant.	5 months.	Papulæ per totum corpus dispersæ.	Without.	Premature birth at 6 months of a macerated boy. Placenta œdematous and fatty.
37.	18 years. Servant.	5 months.	Maculæ per totam cutem dispersæ.	Without.	Girl, at full term. Died 30 days after.
38.	20 years. Workingwoman.	3 months.	Papulæ ad genitalia.	Without.	Abortion at third month.
39.	24 years. Lived with her parents.	8 months.	Maculæ et papulæ dispersæ.	Without.	Boy at full term. Psoriasis. Died in 2 months. (*Tabes.*)
40.	29 years. Servant.	2 months.	Maculæ in extremitalibus.	Without.	Boy at full term. Died 30 days after. (*Pneumonia.*)
41.	20 years. Charwoman.	7 months.	Papulæ dispersæ.	Without.	Girl at full term. Died 6 days after.
42.	27 years. Servant.	7 months.	Papulæ dispersæ.	Without.	Seven months' macerated girl.
43.	28 years. Charwoman.	3 months.	Papulæ dispersæ.	Without.	Boy at full term. Died 24 days after.
44.	18 years. Workingwoman.	3 months.	Papulæ coacervatæ excoriata circum anum.	Without.	Macerated boy, full term.
45.	28 years. Charwoman.	1 month.	Papulæ ad genitalia.	Without.	Living girl, full term. Adopted.
46.	38 years. Laundress.	2 months.	Papulæ dispersæ.	Without.	Abortion at third month.
47.	34 years. Servant.	4 months.	Maculæ et papulæ per totam cutem.	Without.	Girl at full term. Died 6 days after.
48.	32 years. Charwoman.	Could not be determined. Last coitus 3 weeks.	Adenitis universalis. Papulæ per totam cutem.	With.	Abortion.
49.	28 years. Servant.	8 months.	Papulæ excoriata circa genitalia.	Without.	Boy at full term. Marked icterus. Died 2 days after.
50.	24 years. Servant.	5 months.	Papulæ ad genit. et inter digitos.	Without.	Boy, full term. Died 13 days after.
51.	23 years. Servant.	8 weeks.	Maculæ et papulæ per totam cutem.	Without.	Girl, full term. Died 30 days after.
52.	22 years. Servant.	7 months.	Papulæ dispersæ.	Without.	Boy, full term. Died 24 days after.
53.	21 years. Servant.	5 months.	Ulceri in labiis majoribus. Papulæ.	Without.	Boy at full term. After 14 days maculæ appeared. Died 46 days after.
54.	21 years. Cook.	5 months.	Papulæ excoriata in genitalibus et inter digitos Psoriasis plantaris subsequa.	Without.	Boy at full term. Died 7 days after.
55.	30 years. Servant.	3 months.	Papulæ dispersæ, in tonsillis et in palato molli.	Without.	Girl at full term. Died 90 days after.
56.	32 years. Charwoman.	6 months.	Maculæ et papulæ dispersæ. Psoriasis plantaris. Iritis specifica.	With.	Abortion at sixth month.
57.	34 years. Laundress.	1 month.	Papulæ in portione vaginale.	Without.	Girl at full term. Died 15 days after. (*Pneumonia.*)
58.	28 years. Servant.	5 months.	Papulæ per totam cutem dispersæ.	With.	Boy at full term. Died 10 days after. (*Iles-typhus.*)
59.	30 years. Charwoman.	2 months.	Papulæ ad genitalia.	Without.	Boy at full term. Died 23 days after.
60.	25 years. Workingwoman.	6 months.	Papulæ per totam cutem dispersæ.	Without.	Premature live birth. Died 4 days after.
61.	23 years. Charwoman.	8 months.	Papulæ confluentis circum anum et in labiis pudendis. Psoriasis.	Without.	Boy, full term. Died 14 days after.

REPORT ON THE MALIGNANT ANTHRAX IN HERDS, AND MALIGNANT PUSTULE IN MEN, IN LIVINGSTON COUNTY, N. Y., IN SEPTEMBER, 1875.

By PROFESSOR JAMES LAW, *of Cornell University, N. Y.*

PRESENTED AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

THE disease appeared on the estate of James W. Wadsworth, Esq., on the "Street Farm," one and a half miles northwest of Avon. The affected herd consisted of two hundred and seventy-seven steers, which had been purchased in Canada at various times during last spring, up to the first week in May. All went well until the first week in August, when five steers died suddenly and unaccountably. The remainder continued to thrive rapidly until the first week in September, when they began again to sicken, and died at a rate varying from three to eight every twenty-four hours. At the date of my visit, September 13 and 14, forty had perished including the five deaths during August, and fifty more were seriously ill. Others selected from the herd on the slightest suspicion, and so well and lively that they were caught and handled with difficulty, had their temperature elevated to 103°, 105°, and even 107° Fahr. In some the course of the malady was short: from a condition of apparent health they would suddenly drop behind the herd, and after lying dull and panting for a time, would die in convulsions, not more than an hour after the seizure. The other victims dropped out of the herd, moved stiffly and listlessly, cropped the grass rarely and as if from habit rather than appetite, arched the back, drooped head and ears, and inclined to lie down. The eyes became dull, the horns usually hot at their roots, the muzzle variously moist or dry, and the breathing, pulse, and temperature natural or only slightly increased. The visible mucous membranes showed a dusky brown or yellowish tint, and blood often escaped with the fæces, or less frequently with the urine or from the nose. In some carcases immediately after death, the blood oozed from the skin, especially along the lower part of the trunk and inner sides of the limbs. It invariably escaped from the everted dark-red and tumid rectum. The blood coagulated loosely and imperfectly, the mucous folds of the rectum were of a deep port-wine hue, and the spleen engorged almost to rupture with a dark diffluent blood. The dusky hue of the mucous membranes pervaded the adipose tissue as well, and petechiæ were abundant throughout the body; cadaveric rigidity was little marked, and lasted but a short time. Flies collected on the bodies in immense numbers, even before death, evidently attracted by the odor of decomposition.

Three Herdsmen Infected.— The manager of the farm and two German workmen, who had opened several of the carcases, became infected from the

malignant pustules. The first symptom in each of these men was the eruption on the hand of a small papule which increased to a vesicle, burst and dried up, while a new crop appeared around the point of desiccation. The two older men — from thirty to forty years of age — had considerable erysipelatoid infiltration of the hand and arm, with high fever, nausea, great languor, and muscular pains. They ultimately did well, however, under the care of Dr. Nesbit, who deeply cauterized the sores, had the arms slung and painted with iodine, and administered bark and iron. The third victim, a very robust man of about twenty, scarcely suffered except from the local eruption, which at the time of my visit appeared as a number of raw sores upon hand and arm, each about half an inch in diameter, with an elevated red congested margin, but a healthy suppurating centre. This man adopted no surgical nor medical treatment, but threw off the poison apparently by his inherent vigor and vitality.

Causes of the Outbreak. — The points of especial interest are: 1. The development of malignant pustule in man as the result of inoculation from the diseased steers; and 2. The conditions which appeared to contribute to the outbreak among the cattle.

The first point has been sufficiently noticed. Of the pathogenic influences affecting the bullocks we may notice — (1.) *Plethora.* — The stock came on the farm in April and the first week in May in a very low condition. They were fed first on corn, and afterward on the luxuriant grass of the rich bottom lands of the Genesee River, and laid on flesh with marvelous rapidity. At the period of the attack they were in very high condition, and the most plethoric were the first to be seized. The blood, in short, was not only charged to the highest degree with assimilable elements, but also with the effete products of rapid tissue-changes, and presented the best possible field for the propagation and growth of organic or septic poisons. (2.) *An Impervious Subsoil.* — The stock had the run of three inclosures, two meadows dotted with fine old shade trees and a cedar swamp. All had a subsoil of impervious clay, which approached nearest to the surface in the swamp and the lower meadow, but lay at a depth of several feet in the upper meadow. This land was overflowed by the river every spring, and there being no natural nor artificial drainage the water had to escape by evaporation mainly. (3.) *Rich Surface Soil and Organic Emanations.* — The surface soil was a rich alluvion, and was improved, if possible, yearly by the deposit from the regular spring inundations. During the summer, therefore, there were not only the materials for producing the richest vegetation, but for the disengagement of abundant organic emanations from the decomposing remains of animals and vegetables. In the absence of drainage, all which the vegetation failed to utilize must pass off as malaria, and the period of the outbreak was toward the end of the hot season, when the ground must have attained its maximum of dryness, and when decomposition was taking place at the greatest depth, and consequently in the greatest thickness of soil. (4.) *Summer Heat.* — The heats of summer were rendered much more intense in these perfectly sheltered pastures than in more exposed localities. Nothing could serve more to hasten drying of the soil and organic decay,

and the later the season the more deeply would the heat and active decomposition have penetrated. (5.) *Alternations of Temperatures of Day and Night.* — I have been unable as yet to secure the metereological register for September in the Genesee Valley; but that of Ithaca, one hundred miles due east, will give a fair approximation. During the last seven days of August the lowest temperature reached at Rochester was 64° Fahr., the highest 80°; at Ithaca, the lowest 50°, the highest 82°. During the first seven days of September the lowest at Ithaca was 51°, the highest 87°; during the second week of September, the fatal period, the lowest was 36°, the highest 79° Fahr. But the highest temperature in the shade gives but an imperfect idea of the heat sustained under the direct rays of the noonday sun in these sheltered meadows. The contrast between the mid-day heat in the sunshine and midnight cold was extreme, and in the vicinity of Ithaca contributed to a wide prevalence of diarrhœa and dysentery among the human population. These chills had doubtless a material effect, but to attribute the outbreak mainly to these vicissitudes would be untenable, for from the 22d to the 24th of September the night temperature touched the freezing point without any bad result.

The most universally acknowledged causes of the malady in animals are — plethora, or a state of the blood highly charged with organic elements, an impervious soil or subsoil for pasturage, a very rich surface-soil, inundations, a period of heat and dryness calculated to foster decomposition of organic matters to a great depth in the ground; and a great contrast between the day and night temperatures, and in this case all coincided in their influence to produce one of the most malignant types of the disease. It may be added, that while this affection is communicable to all animals by inoculation, it can scarcely be said to spread in any other way, and is, therefore, to be looked upon as essentially an enzoötic disease. We must go to such places as the inundated margins and deltas of large rivers, dried-up lakes and marshes, or the rich and pestilential Russian Steppes, to find any approximation to the disastrous outbreaks in man and beast which blacken the history of past ages. What was done to check the disorder remains to be noted. One hundred of the best steers were turned on a higher pasture with a gravelly subsoil. The remainder were of necessity left in the higher of the two meadows formerly occupied, but were fenced out from the swamps and low meadow where the clay approached near to the surface. All of both herds were fed with hay watered with a solution of carbolic acid and bichromate of potass. The fifty sick bullocks took small doses of nitro-muriatic acid and bichromate of potass. by the mouth, and a solution of sulphate of quinia, iodide of potassium, and bisulphite of soda, hypodermically, each repeated twice daily. The result was, that of the fifty animals seriously ill on the 14th, only two died, and the rest made a prompt and perfect recovery. Only two new cases occurred on the 15th, and these were the last.

V.

REPORTS UPON YELLOW FEVER.

YELLOW FEVER IN PENSACOLA, FLA., IN 1873, 1874, AND 1875.

By GEORGE M. STERNBERG, M. D.,

Surgeon and Brevet Major United States Army.

READ AT THE MEETINGS OF THE ASSOCIATION IN PHILADELPHIA AND BALTIMORE.

In the "American Journal of Medical Sciences" for April, 1873, the writer, in discussing "the nature of the yellow fever poison," arrives at the following conclusion: —

"Yellow fever is an infectious disease, produced by the action upon the human system (directly or indirectly) of a specific living germ, which finds the conditions essential to its multiplication, external to the human body. The germ is an exotic in the United States, and is destroyed by a freezing temperature, but may sustain its vitality for an indefinite length of time, at temperatures too low for its increase, and will regain its reproductive power when subjected to a continued temperature of about 80°."

The proper steps to be taken for the prevention of the disease are then briefly stated as follows: —

"(*a.*) To prevent the importation of germs.

"(*b.*) To destroy them by such means as are in our power, wherever their presence may be suspected.

"(*c.*) To remove all unprotected persons from their influence when their presence at any point is ascertained."

Since the above was written, the writer, while on duty as post surgeon at Fort Barrancas, Fla., has had an opportunity to make himself familiar with the facts connected with the introduction and progress of yellow fever in Pensacola Harbor, for two consecutive seasons, and to put the above to the test as a "working theory." It is the object of this paper to state these facts as concisely as possible, and to give the results of the preventive measures taken for the protection of the garrison of Fort Barrancas. By some it will doubtless be considered unnecessary to insist upon the truth of a theory, which is probably now accepted by a majority of the profession, which is the "working theory" of the health authorities of nearly all of our seaport cities, and which is clearly stated as an established truth in two of the latest and most authoritative works upon medicine.[1]

[1] In the article upon yellow fever, by John Dennis Macdonald, F. R. S., in vol. i. of Reynolds' *A System of Medicine*, p. 658, "the tenets of the writer" are stated as follows: —

a. "That the first place or the first person, or both, must have become infected somewhere or somehow.

It is, however, unfortunately true, that very many physicians and a great majority of the laity, in those sections of the country where yellow fever most frequently prevails, still adhere to the old idea of the local origin of the disease, as a result of atmospheric and telluric influences, while many others, believing that there can be but two horns to the dilemma, insist upon its contagious nature.[1]

The prevalence of these views has been, and is, the great obstacle to the successful application of proper preventive measures in many localities where yellow fever is most frequently introduced. When the mass of the people, headed by a respectable number of physicians, insist that the disease is a necessary evil, resulting from annually recurring climatic conditions, it is useless to expect their support in the maintaining of a quarantine for its exclusion. And any effort made to destroy the "materies morbi" of the disease by the use of disinfectants, will naturally be considered farcical by persons entertaining such a belief.

Again, those who believe the poison to be an emanation from the persons of those sick with the disease, naturally consider the most efficient preventive measures to be, isolation of the sick, and speedy burial of the dead. Whereas, experience has demonstrated that the removal of the sick from an infected locality does not stay the progress of an epidemic,[2] nor do the sick when removed to a healthy locality necessarily endanger the unprotected persons with whom they may come in contact, although they are likely, if proper precautions are not taken, to be carriers of the poison, and new centres of infection may be established by reason of their removal.

b. "That by veritable, but unknown, or rather untraced links with this source, places having become infected, may infect persons.

c. "That persons infected may infect other persons and places previously presumed to be healthy.

d. "That the clothing of infected persons, or of healthy persons having communicated with infected places or persons, may impart infection to other places or persons.

e. "That if places were movable, like persons (which is literally true of ships), on being infected, they would impart the virus to other places in sufficiently close proximity."

In the very excellent article on Yellow Fever, by Haenisch, in Ziemssen (*Cyclopædia of the Practice of Medicine*, Ziemssen, American edition, Wm. Wood & Co., 1874), on page 493 (vol. i.), we have the following: —

"Yellow fever is most probably produced by a living miasm which has hitherto entirely eluded microscopic demonstration, but the existence of which is argued from very many facts. These seeds of the disease, as soon as they become in any way established in the human organism, set up in it that diseased process to which we are accustomed to give the name of 'yellow fever.' They are not, however, reproduced in this diseased organism, they do not multiply in it, nor migrate from it to other men; yellow fever is not then, in this sense, a contagious disease. But its seeds long retain their poisonous nature; they are, under certain circumstances, quite indestructible, and when placed in suitable external conditions are capable of kindling an epidemic even far away from their place of origin."

[1] The word is here used in its popular sense, which is, to express the idea of a disease produced by the influence upon a well person of a poisonous emanation from the body of one sick with the disease.

[2] At Governor's Island, in 1870, new cases continued to occur, until frost put an end to the epidemic, although the sick were all removed to the West Bank Hospital in the "lower bay," while no cases occurred among the (ten) unprotected inmates of the hospital, from the admission to its wards of one hundred and fifty patients sick with yellow fever. (See *American Journal of the Medical Sciences for April*, 1873, pp. 398-406.)

On the other hand, a false confidence often results from a belief in the propagation of the disease by a personal contagion, which may lead to disastrous consequences. A vessel from an infected port, having an infected cargo, may arrive in one of our harbors, without a case of yellow fever having occurred on board to demonstrate the fact. This will be the case when the master and crew have suffered attacks of yellow fever at some previous periods in their lives (not an unusual thing for the crews of vessels sailing from ports where the disease is endemic). Again, when the disease has prevailed in a certain locality, and all the sick have been removed, or have recovered, or died, the belief is very general that the dangerous element has been removed from the locality, and people often visit it without hesitation, who could not be induced to approach the bedside of one sick with the disease, or the harmless corpse of one who has recently died from it.

I consider it a matter of the greatest importance to the community at large, and to individuals who may be so unfortunate as to suffer an attack of yellow fever, that this fact should be generally recognized, namely: *that the sick are dangerous to the well, not as generators of the poison, but as possible carriers of it to new localities.* It is very probable, however, that the atmosphere of the sick bed (and of the sick room as it is ordinarily found), is extremely favorable to the rapid multiplication of the germs. There are well-informed men in the profession who reject "the germ theory," on the ground that the germs have never been demonstrated by the microscope, and described, named, and classified. Until such demonstration is made, we cannot claim that the truth of the theory is absolutely proven. But I cannot admit that the absence of such demonstration disproves a theory, which, in my opinion (so far as yellow fever is concerned), rests upon as substantial a basis as the atomic theory of matter.

Whether or not, the facts about to be detailed, added to the mass of evidence of a similar nature, already recorded in the copious literature of the subject, prove equally convincing to others, — the value of the theory as a guide to successful preventive measures, cannot be denied.

Yellow fever was introduced into Pensacola harbor, in 1867, by the English ship *Fair Wind*, from Jamaica.[1] It did not again prevail until 1873, when it was introduced by the ship *Golden Dream*, from Havana.[2]

[1] See *Report on Quarantine on the Southern and Gulf Coasts*, by Harvey E. Brown, Assistant Surgeon U. S. A., p. 38.

[2] The following extracts from a letter written me at the time by Dr. R. S. Hargis, of Pensacola, give the facts concerning its introduction: "The *Golden Dream* arrived on the 10th of June, was sent to the quarantine station, and remained there until July 3d, when she was admitted to *pratique;* no deaths after her arrival until the 5th inst., when one of the new crew, that had been shipped eight days previously, died after an illness of three days, — had black vomit. Two other men were sick at the time, and it is reported that both died, but I cannot obtain any reliable information in regard to the facts; the ship has gone to sea. I attended a case on board the bark *Bismarck* that died after having black vomit. This vessel was moored at the end of the Perdido Railroad Wharf, a few hundred yards from the *Golden Dream*, with which the crew had frequent intercourse. This unfortunate vessel will, no doubt, be swept of her men from stem to stern in less than ten days. The *Golden Dream* discharged the greater part of her ballast on the other side of the bay; the remainder was not removed. A few tons of coal were delivered to parties on

In 1874 the disease was again introduced into the harbor by the Spanish bark *Doce de June*, which arrived at the quarantine station on the twenty-ninth day of May, having on board one man sick with yellow fever, and having lost one from the same disease during her passage from Havana. The disease continued to prevail at the quarantine station during the months of June and July, but did not effect a lodgment in the city until the latter part of August.[1]

It will be seen that in 1873 an interval of two months, and in 1874 of nearly three months elapsed, after the arrival of an infected vessel at the quarantine station, before the first cases of yellow fever occurred in the city. When, however, the infection had once obtained a foothold, it continued to increase, and to extend itself in all directions, until the greater part of the city was pervaded by it. Its malignancy is shown by the fact that in 1873, sixty-three deaths, and in 1874, 118 deaths from yellow fever occurred in the city of Pensacola alone. Unfortunately there is no record from which the total number of cases can be obtained.

In 1873 no precautions were taken to prevent the disease from reaching the city of Montgomery, 160 miles distant, and connected with Pensacola by railroad. The result was that the infection was transported to that city by fugitives from Pensacola, and a large number of cases and deaths occurred. The following year a very efficient quarantine against Pensacola was promptly established by the authorities of Montgomery, and that city entirely escaped a revisitation of the scourge. At the Pensacola navy yard the reverse was the case. The quarantine, established August 16, 1873, was effectual in preventing the introduction of the disease to the navy reservation. But the following year, unfortunately, the naval authorities did not establish a quarantine against Pensacola until August 31, at which time one death from yellow fever had already occurred in the navy yard, and eight

shore. She never was at the wharf, but was loaded a few hundred yards from the central wharf, about equal distance from the latter and Perdido Railroad Wharf.*

"My first and second cases occurred on the 10th August, third on the 11th, fourth and fifth on the 13th. . . . . Four only of my cases were known to have been on board the *Golden Dream* . . . . I have not the least doubt but that to the *Golden Dream* may be traced the infection."

[1] The following extract from a letter written me at the time by my friend Dr. James S. Herron, the physician in charge of the Marine Hospital at Pensacola, gives a clear account of its introduction: "In the last few days several cases of yellow fever have appeared in this city. Dr. Hargis has lost two, — one in the city, and one on the bark *Patsey Dorsey* at the wharf, one yesterday, and one the day before [date of letter August 30]. I lost two in the hospital to-day. One came in at eleven o'clock yesterday, and died at eleven o'clock to-day with black vomit. The other came in on the 26th, and died at 7.30 this A. M., without black vomit, but evidently of the relapse of yellow fever. The history of my two cases is, that they were landed from the bark *Elmira Coombs* a week ago, and went to the sailors' boarding-house, at which they stayed until admitted to the hospital. . . . . This vessel is from Aspinwall, and all the men had been down with 'Chagres fever.' The vessel was detained in quarantine only five days. The men had no medical attendance while in the boarding-house. . . . . They were boarding opposite to the woman whom Dr. Hargis lost. . . . . The worst feature in this case is that these men were a week in a boarding-house, and that a woman opposite took it, evidently from them. My opinion is that this fever was contracted at quarantine station, where it has been since last May."

* The *Golden Dream* was soon after reported in the *New York Herald* as "found at sea, abandoned."

days after the disease had been introduced into the sailors' boarding-house in Pensacola.[1] The infection having once established itself, quickly took possession of the whole yard, and of the adjoining villages of Warrington and Woolsey, giving rise to an extremely fatal epidemic.

The naval and military reservations, upon which are located the Pensacola navy yard, and the post of Fort Barrancas, occupy the extremity of a peninsula bounded by the Bay of Pensacola on the south and the "Grand Bayou," an arm of the bay, on the north. The road to Pensacola, which is nine miles distant, crosses the "Bayou" near its mouth, by a bridge one fourth of a mile long. The commodore commanding the navy yard placed a guard of marines at the crossing of this bridge, and was thus able, very effectually, to prevent communication with the infected city. The naval reservation being between the infected point and Fort Barrancas, the latter place enjoyed equal protection with the former from any quarantine regulations enforced by the commodore. Yellow fever was introduced into the city of New Orleans, by the barque *Valparaizo*, about the same time that it reached Pensacola. The extract from a letter here quoted, dated August 20, 1873, from my friend Dr. C. S. Russell, Secretary of the Board of Health for the city of New Orleans, gives the facts concerning its introduction, and probably may explain the manner in which it reached the cities of Memphis and Shreveport, shortly afterward.[2]

Having received this information I was on the alert to guard every avenue by which the infection might be brought to our garrison. In this endeavor I was thoroughly sustained by the commanding officer, General J. M. Brannon. With the view of preventing all necessity for communication with New Orleans, quartermaster's and subsistence stores were asked for in July in sufficient quantity to last until November 1. These stores were received prior to August 30, and from that date until October 24, no vessel from New Orleans touched at the Barrancas wharf. With a single exception, the garrison of Fort Barrancas had no direct communication with the infected cities from the time quarantine was established (August 16), until the occurrence of frost (October 29). The exception was in the case of a recruit who arrived in Pensacola August 20, and informed the commanding officer by letter, that he was under orders to report for duty at this post. In compliance with the suggestion of the post surgeon, this man was directed, by letter, to come to the "Bayou" bridge, on the following day. He was there met by a mounted orderly, who conducted him to a tent which had been prepared for his reception. The tent was pitched near the garden a mile north of the "barracks." I met him at this place, and required him immediately to strip and take a disinfecting bath (carbolic acid, impure, one part,

[1] See extract from Dr. Herron's letter, already quoted.

[2] "Our first case was from the barque *Valparaizo*, which left Havana, June 16, arrived here and was detained at quarantine until the 26th of June; came up to the city,— all well until the 4th of July, when the mate was taken sick with yellow fever and died of it on the 8th of July. The barque communicated it to the river steamer *Belle Lee*, lying at the wharf above, and to the *Wm. S. Pike*, still above the *Lee*. We have had from that source ten cases and seven deaths. . . . . Now I am satisfied that time only is nothing at quarantine, unless the ship and cargo be thoroughly disinfected. Without disinfection and perhaps, breaking of cargo, *it only gives the poison time to grow in strength and power.*"

to one hundred parts of rain water). The clothing he had taken off was then placed in a tub containing a solution of carbolic acid (one to fifty), and a new suit of clothing was given to him. He was then sent to a vacant house near the garden and detained there under observation for a week, after which he was permitted to join his company.

The mail which reached us daily, by way of Pensacola, was fumigated with sulphurous acid gas before being distributed. I felt very confident that the precautions taken could be relied upon, so long as our neighbors on the navy reserve were successful in keeping free from the disease. And, looking upon the navy yard and adjoining villages as an outpost for receiving the enemy, and giving us timely warning of its approach, I was constantly on the alert for the appearance of the first case there, which was to be the signal for removing our garrison, across the bay, into camp near Fort Pickens. While thus keeping my eye on the outposts, the enemy by a strategic movement, which I shall shortly relate, got possession of my citadel, and on the 26th of September I had four yellow fever patients in the post hospital, and two in the small house situated in its immediate vicinity.[1]

[1] The following extract from a letter written to the Surgeon General United States Army, at the time, will give the facts in regard to this outbreak of fever in the post hospital, and my theory in regard to the manner in which the infection was introduced.

"*General,* — I have the honor to inform you that I have at present (date of letter September 26) under treatment in the post hospital, two cases which I believe to be yellow fever. The following is a brief statement of the facts upon which this belief is founded. Private Farrell, who has been a patient in the post hospital for two months past (suffering from anæmia), was taken with a chill on the morning of the 23d instant, followed by fever, pain in the head and loins, flushed face, lustrous eyes, and frequent vomiting of bilious matter. Private King was a patient in post hospital, from September 19 to September 22 (treated for intermittent fever); was returned to duty September 22. Was taken with a chill on the afternoon of September 23 and presented exactly the same train of symptoms as preceding case. Both were at first supposed to be cases of remittent fever, and frequent temperature observations were taken to confirm the diagnosis. The following is the record to date: —

Private Farrell. September 23, 2 P. M., 104.5°, 6 P. M., 104.5°, midnight, 104.5°. *September* 24, 7 A. M., 105°, 10 A. M., 104.5°, 6.30 P. M., 104.5°, midnight, 104.5°. *September* 25, 7 A. M., 104°, 10 A. M., 105°, 12.30 P. M., 104.5°. *September* 26, 7 A. M., 102.5°. . . . .

Private King. September 23, 7.30 P. M., 105°. *September* 24, 7 A. M., 105°, 10 A. M., 104°, 6.30 P. M., 105.5°, midnight, 104.5°. *September* 25, 7 A. M., 105°, 10 A. M., 105°, 2.30 P. M., 104°. *September* 26, 7 A. M., 102.8°.

"It will be seen from the record of temperature that no remission occurred on the 24th or 25th. . . . . On the morning of the 26th, however, a partial remission occurred which has already lasted nine hours, and the patients both express themselves as feeling quite well (evening of September 26). On the evening of the 25th, having doubts of the correctness of my first diagnosis, I tested the urine of both these patients, and found it loaded with albumen. This morning two other patients with fever have presented themselves. *Private Clark* has been an inmate of the hospital since September 11 (disease dyspepsia). Temperature at 7 A. M., 104.5°. Has a severe headache and pain in loins. No chill. *Sergeant Adams,* admitted to hospital on the evening of the 25th. Has this morning a temperature of 103.5°. This man was a patient in hospital from September 7 to September 24 (disease gonorrhœa). I have been called this afternoon to see the two children of Private Schwartz, who lives in a small frame house, less than thirty yards distant from the hospital. Both have high fever, flushed faces, and headache; no chill. It will be seen that two of the cases of fever reported — Privates Farrell and Clark — have been continuously in hospital for some time past, and that Private King and Sergeant Adams were discharged from hospital but a short time before they were taken with their present sickness. *The post hospital,*

Having, on the evening of September 26, satisfied myself that Farrell and King had yellow fever, I at once reported the fact to the commanding officer, and recommended the immediate removal of the command to the camping ground near Fort Pickens, which had been selected some time previously, in anticipation of such an emergency. On the morning of the 29th the movement into camp was completed, and from that time until the occurrence of frost, every precaution was taken to prevent the infection from reaching the troops in their harbor of safety. Rations were taken to last until November 1, and nothing that could by any possibility carry the poison was allowed to go from our side of the bay to the camp until it had been thoroughly disinfected. The mail was disinfected by submitting it to the fumes of burning sulphur in a close box, constructed for the purpose. A boat was sent daily from Pickens to the Barrancas wharf, but the crew was not permitted to land, and the boat remained no longer than was necessary for the exchange of the mail. After the removal of the main part of the command into camp, there remained at Fort Barrancas, General Brannon, commanding post, Assistant Surgeon G. M. Sternberg, U. S. A., post surgeon, and twenty-six enlisted men. Of the enlisted men, fourteen were at the post hospital, namely, one steward, one ward-master, three attendants, one cook, and eight patients.

The measures taken were entirely successful in protecting the command in camp from yellow fever, and the general health of the troops was excel-

therefore, seems to be the infected point, and the question arises, How was the disease brought here? No cases of fever have been reported in the neighboring towns of Warrington and Worlsey on the naval reserve; no direct communication with the infected cities of Pensacola and New Orleans has been permitted since it has been known that yellow fever was prevailing in those cities. But, depending upon the quarantine established by the Commodore commanding the naval reserve, and believing that it would be time enough to establish a quarantine against the towns thereon, when a case of yellow fever was known to have occurred there, visits to these towns for the purchase of provisions, etc., have been permitted up to the present time. Upon inquiry made last night, I found that the hospital steward purchased on the 15th instant a barrel of potatoes from Mr. Quayle, a merchant of Warrington. This barrel was brought to the post hospital on the same day, and the potatoes were emptied on the floor of the storeroom. A few rotten potatoes were picked out and thrown over the fence, towards the house where the two children have fever this afternoon. I drove to Warrington this morning and inquired where the barrel of potatoes came from. Mr. Quayle informs me that it was one of four landed by the steamer *Amite* on the day that they were purchased. Two barrels of the four remain in his store unopened, and the other he has sold out by the peck. The steamer *Amite* is plying between the cities of New Orleans and Pensacola, and has been permitted, by the Commodore commanding, to bring certain articles for the merchants of Warrington, and leave them on a flat-boat anchored out in the bay, at a considerable distance from the Warrington wharf. It may hereafter prove that yellow fever has reached this hospital through some other channel than the one suggested, but to me there seems nothing improbable in supposing that a barrel of potatoes, brought from the infected city of New Orleans by the, probably, infected steamer *Amite*, and opened in the hospital on the 15th, may have contained 'germs,' which, finding favorable conditions for their development, have given origin to the cases of yellow fever now in the hospital wards." *

* All the cases above referred to proved to be unmistakable cases of yellow fever. Private Farrell and the two Schwartz children died. The others recovered. I have since learned that some of the potatoes were sent, soon after the barrel was opened, to the house where the two children were taken sick on the 25th, in payment for potatoes previously borrowed.

lent during the whole time they remained in camp. The further history of the disease renders it highly probable that very few would have escaped an attack if they had remained in their quarters. As soon as the diagnosis was established in the cases of Farrell and King, I commenced making every effort to arrest the progress of the disease by the use of disinfectants. With this view every room in the hospital building was thoroughly fumigated with sulphurous acid gas, and the floors of the wards, hall-ways, and galleries were daily sprinkled with a solution of carbolic acid. The fumigation was several times repeated during the first week, the patients being removed from one ward to another, so that no portion of the building might escape the disinfecting process. After the death of the two Schwartz children, which occurred on the 28th September, the family was removed to a house in another part of the garrison, and their bedding, clothing, etc., were thoroughly fumigated, and the house in which they had lived was disinfected with carbolic acid and sulphurous acid gas. No more cases of fever occurred in this family, which consisted of Schwartz, his wife, a grown daughter, and small child ; and no new case of fever occurred in the hospital until the fourteenth day of October, when Private Harkin, a hospital attendant, was taken sick with remittent fever. The presence of albumen and tube-casts in the urine on the fourth day makes it probable that this case partook, to some extent, of the nature of both diseases. The remittent element was, however, most prominent, as was shown by the temperature observations.

If we suppose that this man received the yellow fever poison into his system at the same time and from the same source as the cases which occurred on the 23d and 25th of September, we have the evidence that the remaining inmates of the hospital, six in number, escaped the disease until after it was re-introduced, October 23, in support of the presumption that the measures taken were successful in destroying the infection which gave rise to the four cases upon the dates first mentioned. While the progress of the disease was arrested at the post hospital, a new centre of infection developed itself in October, and furnished a number of additional cases. There are four brick buildings immediately in rear of "the barracks."[1] One of these was occupied by Commissary Sergeant Clifford and Private Davis and families, and is the infected locality referred to. The inmates of this house were taken sick with yellow fever in the following succession : Child of Davis', aged 6, September 29 ; Mrs. Clifford, October 11 ; Mrs. Davis, October 15 ; Sergeant Clifford, October 19.

The enlisted men (8) who remained at Barrancas to take charge of the government property, messed together in one of the four brick buildings in the rear of "the barracks" (the second one from that occupied by Clifford and Davis). Three of them were taken sick with yellow fever, namely, Bugler Hunter, October 14 ; Private Allen (gardener), October 15 ; Private Quinn (teamster), October 14. These men were treated in the post hospital, and, I believe, introduced the infection into the building a second time. The evidence of this is, that Private Hastings, a patient in hospital since October 9 (suffering from chronic diarrhœa), was taken

[1] A three-story brick building, 370 yards distant from the hospital.

sick with yellow fever, October 23, and Private Johnson, hospital cook, on the 25th. The hospital, after the admission of those new cases, was again thoroughly and repeatedly disinfected with sulphurous acid gas and carbolic acid.

The evidence in regard to the value of the measures resorted to for destroying the infection in the post hospital, may be summed up as follows: The hospital became infected from some source, as is proved by the fact that four of its inmates were taken sick with yellow fever on the 23d and 25th September. The other inmates at this time were, four patients, three attendants, one steward. No more cases occurred until October 23 and 25. In the mean time three yellow fever patients were admitted on the 14th and 15th of October, from an external source, and subsequently another on the 31st of October. The hospital steward, two patients, and two attendants, lived in the building, and were in constant attendance upon the sick, but did not contract the disease. The question will be asked, How did the infection reach the Clifford and Davis quarters? I am sorry to say, I have been unable to obtain any satisfactory answer to this question. But it is not improbable that "germs" were transported from the hospital before the disease developed itself there. One of the hospital attendants had his washing done by Mrs. Davis, up to the time that the fever made its appearance in the hospital. In 1874 all communication with the city of Pensacola was prohibited by order. On the 10th day of August yellow fever had not yet made its appearance in the city, but had been prevailing at the quarantine station for more than two months, and there was little doubt but that it would soon reach the city, as the health authorities acknowledged their inability to prevent stevedores and others residing there from visiting the quarantine station. Unfortunately the Commodore in command of the navy yard did not resort to the same measures until August 31, at which time, as already stated, the disease had obtained a foothold, both in the city of Pensacola and in the navy yard. The first case in "the yard" was that of a private of marines, named Wilderhold, who died August 26, after a brief illness of two or three days.

This case was pronounced one of "pernicious remittent fever" by the surgeon of the yard, who had had no previous experience with yellow fever. This diagnosis was subsequently changed to "yellow fever," which it undoubtedly was. On the morning of September 7, the surgeon-in-charge of the navy yard officially announced that Private Hellering, a marine, had died of yellow fever during the preceding night, and that there were four more cases of the same disease in the hospital. Upon receiving this information, I addressed a letter to the adjutant of this post: —

"Sir, — I have the honor to inform you that I have reliable information that a death from yellow fever occurred at the navy yard last night, and that there are four more cases reported by the surgeon-in-charge. Two of these cases I have seen, and I confirm the diagnosis.

"I would respectfully recommend that all intercourse with the naval reservation be discontinued, and that as soon as possible, the garrison of Fort Barrancas be moved into camp on Santa Rosa Island, as an absolutely protective quarantine between the army and navy reservations is practically impossible."

In accordance with this recommendation, the garrison was promptly moved into camp near Fort Pickens. Until the occurrence of frost (November 1) rendered further restrictions unnecessary, no communication with the infected localities was permitted. The commanding officer, the post surgeon, the hospital steward and attendants, and a sufficient number of enlisted men (nine), to take care of the government property, remained at Barrancas. The only intercourse permitted between those remaining at Barrancas and the naval reserve, was the daily visit of the mail-carrier (a reliable man who had yellow fever at this post last year). The mail was fumigated with sulphurous acid gas as soon as received, and the same precaution was taken with the mail-carrier's clothing.

The movement into camp was completed on the 8th September. On the evening of the 11th, Lieut. J. M. Ingalls was taken sick in camp with a chill, followed by fever, headache, etc. I was not summoned until the next morning. Suspecting his sickness to be yellow fever, I had him removed from the camp to his quarters across the bay at Barrancas. The case proved to be, as I suspected, one of yellow fever. Lieutenant Ingalls had taken an evening walk to the town of Warrington, on the naval reserve, several evenings in succession, immediately preceding our establishment of quarantine against that place. It was doubtless during these walks that he was exposed to the infection which caused his sickness, although no case of yellow fever had yet occurred in the town. That the "germs" had already effected a lodgment in the town of Warrington, when the appearance of the disease in the navy yard was first announced, is shown by the following facts: Joseph Michaels, an employé in "the yard," was taken sick at a liquor saloon where he boarded (frequented by marines), on the 8th. Mr. Cora, a watchmaker, occupying the adjoining house, on the 9th. The tent and bedding used by Lieutenant Ingalls in camp were fumigated with sulphurous acid gas, and as soon as his convalescence permitted, his quarters, bedding, and clothing, were subjected to the same process.

The epidemic on the naval reservation proved to be a very fatal one, and the number of cases was only limited by the number of persons susceptible to the disease, who remained within the influence of the infection.[1]

The distance from the navy yard to the camp on Santa Rosa Island is one and a half miles. In the first-named locality a deadly disease prevailed for two months, while in the latter, a large number of unacclimated persons — one hundred and four men, fourteen women, and twenty-nine children, — enjoyed excellent health, and perfect security. On one side of the bay was the *spark*, on the other, the *powder*. But a mile and a half of tide-water intervened, and *no explosion* occurred.[2]

[1] A majority of the citizens of Warrington and Woolsey were protected by having had the disease during previous epidemics. The number of cases and deaths reported by the surgeon-in-charge of the navy yard: —

Officers	13 cases,	6 deaths.
Officers' Families	20 cases,	5 deaths.
Marines and Sailors	31 cases,	11 deaths.
Employees and Citizens on the Reserve	Unknown,	27 deaths.

[2] In 1867, the garrison of Fort Barrancas was in the same manner protected by prompt

On the occurrence of frost, November 1, quarantine restrictions were removed, and on the 3d, the troops returned to their quarters at Fort Barrancas. Three of the four companies constituting the garrison were detached for special duty in New Orleans, on the 17th September, and were still absent at this date (November 3).

On the fifth day of November, Private Tobin, a hospital attendant, absented himself without leave, and remained absent until some time during the following night, when he returned to the hospital in an intoxicated condition. There had been no case of yellow fever in Warrington for some time previous to this, but early in the epidemic several cases occurred in the liquor saloon where Tobin became intoxicated. On the third day after his return to the post, this man was taken sick with yellow fever, and suffered a severe attack. The facts concerning the origin of this case, and that of Lieutenant Ingalls, already detailed, are very instructive and may be briefly recapitulated as follows: Lieutenant Ingalls contracted the disease by taking evening walks in an infected locality (the town of Warrington), but where no case had yet occurred at the date of his last visit. At the time he was taken sick, his son, aged thirteen, was sleeping in the same tent with him, and other officers and men of the command frequently visited his tent. Yet no one contracted the disease from him. Private Tobin contracted the disease by visiting an infected locality, where several cases had occurred, but none for a month previous to his visit. He was treated in the post hospital, where there were three inmates who had not had the disease, and who did not contract it from him, although frequently present near his bedside.[1]

I submit, in conclusion, that the necessary deduction from the facts detailed, taken in connection with the mass of evidence of the same kind, previously recorded, is that *the yellow fever poison is capable of self-multiplication, independently of the human body* (*which is a property of living matter only*). And *that it is not a personal emanation from the bodies of those sick with the disease.*

SPECIAL REPORT TO THE SURGEON GENERAL U. S. A., IN RELATION TO EPIDEMIC YELLOW FEVER AT FORT BARRANCAS, FLORIDA, IN 1875.

History of the Epidemic.

UPON the appearance of cases of yellow fever in the Post Hospital at Fort Barrancas, in September, 1873, the garrison was at once removed into camp on Santa Rosa Island, and remained there in safety until the occurrence of frost. Again, in 1874, the outbreak of a severe epidemic of yellow fever at the Pensacola navy yard (September 10), made it necessary

removal into camp on Santa Rosa Island, while a severe epidemic prevailed at the navy yard and adjoining villages.

[1] The same precautions were taken in regard to disinfection of clothing, bedding, and wards, as have been detailed in connection with the history of the disease at the post hospital during the previous year.

to remove the garrison from Barrancas to Fort Pickens, and again the removal, together with the stringent quarantine regulations which were enforced, proved effectual in protecting the command from the scourge which proved so fatal among our neighbors on the navy reservation. The experience of these two years gave us considerable confidence in the protective measures adopted, and the annual importation of yellow fever into the harbor was anticipated with a degree of equanimity which had not prevailed during the two preceding years. It was generally felt that the discomforts of a summer camp on a barren, treeless island, formed of white sand, and the depression of spirits which, to a certain extent, is felt by the most stoical person when a fatal pestilence is raging in his immediate neighborhood, were all that the garrison of Fort Barrancas need fear, even if yellow fever again effected a lodgment in the harbor.

I fully shared in this feeling for the following reasons: In every instance in which yellow fever has prevailed as an epidemic in Pensacola harbor, its appearance has been preceded by the arrival of a vessel from an infected port, generally with yellow fever patients on board. No vessel touched at the Barrancas wharf except the coasting steamers from New Orleans. I was in communication with the health authorities of New Orleans, and could depend upon early information if yellow fever made its appearance in that city; in which case the policy of absolute non-intercourse with the infected point would, upon my recommendation, be adopted by the post commander. If yellow fever was introduced into the harbor by a vessel from an infected port coming to load with lumber (as had occurred in 1873 and 1874), there was every reason to suppose that we would be safe, unless the disease first effected a lodgment in the city of Pensacola, in which case I could depend upon medical friends in that city for prompt information in relation to the first cases; and the precautions successfully taken in 1873 and 1874 might be relied upon for the safety of the garrison. But this feeling of security, although based upon previous experience, and a well-settled policy to control us in case the fever made its appearance in the vicinity, proved to be without sufficient foundation, for the reason that all the avenues by which the fever might possibly reach us had not been considered.

On the twenty-seventh day of June the German bark *Von Moltke*, sailing from Havana and bound for Pascagoula, La., for a cargo, put into the harbor of Pensacola in distress, on account of the sickness of her crew. The pilot who brought her in *anchored her in the bay*, *opposite Fort Barrancas*, and then came on shore to spend the night with his family in the village of Warrington. The next morning he took her up the bay to the quarantine station, where it was ascertained by the physician in charge that she had five cases of yellow fever on board, and that one of her crew had died from the same disease while en route from Havana. The *Von Moltke* was thoroughly disinfected while at the quarantine station; and after the entire crew had suffered from yellow fever, and the convalescents were sufficiently recovered to work the vessel, she put to sea, and, changing her destination, sailed for New York.

During the night upon which the *Von Moltke* was anchored opposite Bar-

rancas, the wind was blowing in such a direction as to come from her to the fort.

CASE I. On the 18th of July, twenty-one days after the arrival of the *Von Moltke*, Mrs. O'H., a laundress in feeble health, who was nursing an infant, was taken sick with a slight chill, followed by fever. There was nothing at the outset of this case upon which to found a diagnosis, and it was not until the morning of the third day (July 21) that, by frequent temperature-observations, and by considering the case in connection with others which had in the mean time occurred, I was enabled to establish the diagnosis of yellow fever.

CASE II. Sergeant Henry Correll, Acting Commissary Sergeant, was taken sick on the 19th. His symptoms were those commonly inaugurating an attack of any fever, — headache, pain in loins, flushed face, elevated temperature, etc. I supposed at first that this, too, would prove to be an attack of remittent, and prescribed accordingly. Sergt. C. lived in the laundress' row, in the quarters adjoining those occupied by Mrs. O'H. He consumed daily a large quantity of alcoholic spirits, and it had been a subject of remark among the officers, that if yellow fever made its appearance at the post he would probably be one of its first victims. He was the first. His death occurred on the 22d.

CASE III. On the 20th, Mrs. C, wife of the above named sergeant, was taken sick.

CASE IV. On the afternoon of the 20th I admitted to hospital, from his quarters in the " Barracks," Private Locker of Co. M, 1st Artillery. He had fever, headache, etc. I strongly suspected that I had to do with yellow fever when I found that no remission of the fever occurred in the cases of Mrs. O'Halloran and Sergt. Correll on the morning of the 20th. Still I was not prepared to make a positive diagnosis, and consequently said nothing of my suspicions.

During the night of the 20th I was called to see *Cases* V. *and* VI., privates Murphy and Rosenberg of Co. M. I found these men in their company quarters suffering from fever, headache, etc. They were sent to the hospital. A full dose of Ol. Ricini and a hot mustard foot bath was prescribed for each of them. I visited my patients the following morning with a strong conviction that my suspicions of the day before would be confirmed. The clinical thermometer showed no remission of the fever in any of the cases, and an examination of the urine revealed the fact that in the case of Sergeant Correll it was loaded with albumen. I at once addressed the following communication to the Surgeon General of the United States Army: —

FORT BARRANCAS, FLA., *July* 21, 1875.

GENERAL, — I have the honor to report that six (6) cases of fever have occurred at this post during the past two days (one on the evening of the 18th, one on the evening of the 19th, and four on the 20th), which I believe to be cases of yellow fever. I shall inform the commanding officer that such is my opinion this A. M., and will recommend the immediate removal of the command to some healthy location. The bark *Von Moltke* from Havana, came into this harbor June 28 with four (4) cases of yellow fever on board, having lost one en route. She anchored opposite our post and remained over night, going the next morning to the quarantine station. I can only account for the occurrence of these cases by

supposing that germs from this vessel were wafted or conveyed ashore, and having effected a lodgment, have since multiplied sufficiently to have given rise to the disease.

The prevailing winds have been from the south and southwest since June 1.

Very respectfully, your obedient servant,

(Sgd.) GEO. M. STERNBERG,

Assistant Surgeon U. S. A., Post Surgeon.

I also addressed a letter to the commanding officer of the post, informing him of the facts, and recommending the immediate removal of the command from the infected locality. General Brannon, commanding, although taken completely by surprise, proceeded without a moment's hesitation to put into execution the recommendation made in my communication to him, the importance of which he fully appreciated. Before nine o'clock of the same night, the whole garrison was moved across the bay, with the exception of such men as it was considered necessary to retain for the care of the sick and of the public property at Barrancas.

General and Mrs. Brannon, Colonel Randol, Captain 1st Artillery, with his wife and two children, and Colonel Langdon, Captain 1st Artillery, all voluntarily remained in their quarters, as they had all, with the exception of Colonel Randol's children, previously suffered an attack of yellow fever. There were retained at Barrancas for duty seventeen enlisted men, of whom eleven had previously had the fever. On the 21st, while preparations for moving were going on, two more enlisted men reported sick, and were sent to hospital. During the day the following were also taken sick: James O'Halloran, aged eight years (son of Case No. 1); Margaret Anthony, married sister of Mrs. O'Halloran, who lived in adjoining quarters; Clarence Randol, infant son of Col. A. M. Randol. Colonel Randol's quarters were at a considerable distance from either the barracks or laundress' row and in a direction contrary to that of the prevailing winds. The occurrence of ten cases within so short a time at three separate localities, made it evident to me that the poison was already widely diffused, and this was further shown by the developments of the next twenty-four hours. On the 22d, Mary Gillman, servant to Lieutenant Russell, and her son Henry, aged twelve years, were taken sick in another locality, namely, in Lieutenant Russell's quarters on the east side of the garrison. They had remained over night with the intention of accompanying Lieutenant Russell and his wife across the bay on the following morning. On the same day the following were also taken sick at Barrancas: May Randol, daughter of Col. A. M. Randol, aged five years; Thomas O'Halloran, aged seven months; Frantz Kopp, private, Company F (retained as teamster). The sick list was further increased by the return from Pickens of seven enlisted men, one officer's servant (colored), one laundress, and two laundress' children. On the 23d, there were returned from Fort Pickens ten enlisted men and one child, making the total number of cases since the commencement of the epidemic thirty-seven, with as yet but one death. On the 21st, the Medical Director at New Orleans was applied to by telegraph for additional medical assistance, and on the 23d, Acting Assistant Surgeon Wm. K. Mandeville, U. S. A., reported for duty in compliance with orders from head-quarters of the de-

partment. I at once put him in charge of the laundress' row, organizing it as a branch of the post hospital.

The 24th brought us thirteen new cases, among the number the wife and daughter of Lieut. J. M. Ingalls, 1st Artillery. Two deaths occurred on this day, the infant son of Colonel Randol, and Mrs. Correll, wife of the Acting Commissary Sergeant, who had died on the 22d. By the death of Sergeant Correll and his wife, three helpless children, the eldest less than four years of age, were left orphans. On the 25th five new cases were admitted to hospital, and three deaths occurred. Up to this time there had been no medical officer with the troops in camp, but the arrival of two more Acting Assistant Surgeons from New Orleans now made it possible to send one, Dr. W. Carson, to Pickens. This was very necessary, as the officers had previously often been at a loss to decide whether those who complained of feeling ill were really suffering from yellow fever, or only from some trifling indisposition. Acting Assistant Surgeon Salomon was assigned to duty as my assistant at the post hospital, where he rendered valuable services during the continuance of the epidemic. On the 26th there were four new cases and five deaths. Two only of the new cases came from Pickens, namely, Lieut. G. M. Deshler and one sergeant. Two privates were taken sick at Barrancas (one retained for duty as teamster, and one as baker). On the 27th two new cases occurred at Barrancas, Private Spaulding of Company L, and James Moran, aged four years.

The fact that but two cases were sent from Pickens on the 26th, and none on the 27th, gave us good reason for hoping that the remnant of the command in camp would escape the pestilence as a result of their prompt removal from the infected locality. This remnant numbered forty-eight, including three officers and one officer's wife. No more cases occurred in camp until nearly a month after, when privates Mealey and Barnhardt were taken sick (August 29 and 30). It is evident, therefore, that Pickens was not an infected locality when the command went into camp, and that the numerous cases sent back from there between the 21st and 26th of July, had contracted the disease at Barrancas before their removal. Further, that the disease was contracted by exposure to an infected atmosphere which prevailed in one locality and not in the other, and was not communicated by the sick; otherwise the remainder of the command should have contracted the disease from those taken sick at Pickens. I believe that the precedence by a day or two of the first two cases was due, not to any local conditions originating in their immediate vicinity, but to the fact that they were peculiarly susceptible to the influence of the poison; the one from debility resulting from grief and the care of a nursing infant (Mrs. O'Halloran had recently lost her husband by drowning), and the other from lowered vitality resulting from alcoholic poisoning. This view is sustained by the fact that the other cases in this row had no precedence over those occurring in other parts of the garrison. But how shall we explain the two cases at Pickens a month later? I think it probable that at the time of the removal of the command, or subsequently, yellow fever germs were transported from the infected locality to Pickens, which, by the end of August,

had multiplied sufficiently to give rise to these two cases. Believing this to be the probable explanation of the occurrence of these cases, and taking them as evidence that Pickens was now an infected locality, I advised the immediate removal of the command to another camp. The movement was at once made, and no more cases occurred among this portion of the command. But at Barrancas there were still a number of persons susceptible to the disease, and new cases occurred every day until August 2, when the epidemic ceased for want of material.

On the 28th I was myself taken sick. The other cases on this day were Hospital Steward Wm. E. Hill, U. S. A. (who died August 8), and Arthur Ingalls, aged thirteen, son of Lieut. J. M. Ingalls (died July 31). Five deaths occurred on this day, among them Lieut. G. W. Deshler and Mrs. Ingalls, wife of Lieut. J. M. Ingalls. On the 29th, Private Dearlove of Company A, and Mary Moran, aged six years, were taken sick, and Mrs. Jane Bracken, a company laundress, died. On the 30th, Mary Davis, aged ten, Private Allen of Company A, and First Sergeant Henry, Company M, were taken sick. Sergeant Henry had come over from Pickens on the 25th to nurse his wife and child, who came back sick on the 22d. One death occurred this day, Private Sheeby of Company L. August 1, Richard Moran, aged five years, taken sick; and First Sergeant Robert McFall, Company A, died. August 2, Mrs. Freundscher, laundress of Company A, taken sick; Private Richmond Allen of Company A, died.

So far as the post of Barrancas was concerned, the epidemic was now necessarily at an end, as there was no one left to have the fever except the family of Ordnance Sergeant Carroll. This family furnished a remarkable exception to the rule that all persons who come within the influence of the poison during the prevalence of a severe epidemic, suffer from yellow fever unless protected by a previous attack. Sergeant Carroll and family resided in a small frame-house situated about one hundred yards from the "barracks." The sergeant and his wife had both previously had the fever, and at his own earnest solicitation, the family were permitted to remain in their quarters. On the 24th his son William, aged five years, was taken sick with yellow fever; the remaining children, five in number, escaped.

Four additional cases occurred in the vicinity and were treated by the medical officers at Barrancas, namely, two marines belonging to a picket guard, stationed by the Commodore commanding the navy yard, on the edge of the "cedar grove" looking towards Barrancas; and Mr. J. W. Keough, Superintendent of the National Cemetery, and his wife (taken sick August 13 and 15). Mr. Keough died on the 15th; his wife recovered. The National Cemetery is situated about half a mile northeast of the post.

Upon my being taken sick, Acting Assistant Surgeon Wm. R. Mandeville, U. S. A., was left in charge of the medical department at the post, until the arrival of Assistant Surgeon Harvey E. Brown, U. S. A., on the 5th of August. From this date Dr. Brown performed the duties of Post Surgeon. On the 30th of August, having recovered my strength sufficiently to enable me to travel, I started for the north on sick leave.

Origin of the Epidemic. — I see no reason to change the opinion expressed in my letter to the Surgeon General, of July 21, in relation to the origin of

the recent epidemic. Various other theories were suggested at the time, some of them so wild as to be unworthy of notice; others were sufficiently plausible, but were unsustained by facts. At the time the fever made its appearance at Barrancas and for some time subsequently, there was no yellow fever in Pensacola Harbor, except on board the *Von Moltke;* and none on the Gulf coast except a few cases at Key West, a port with which we had no direct communication. We are therefore forced to the conclusion that the disease germs came to us from the *Von Moltke*, or that they were of local origin. It is improbable to suppose that the germs had remained over from a previous epidemic, as we had but two cases the previous year and the winter had been unusually severe. On the other hand, at Pensacola and at the navy yard, where a severe epidemic prevailed last year, there was not a single case during the present season. Another improbable suggestion was that the germs had been preserved in the baggage of Co. M, which company came from Tortugas during the winter of 1873, after having suffered severely from yellow fever during the preceding summer. But all articles likely to convey the infection were burned by the commanding officer of Company M, before leaving Tortugas; and two winters had passed since, during which the company property was in constant use. Again, the first cases did not occur in this company. Finally, the appearance of cases at several widely separated localities about the post, within so short a time, and the rapid development of the epidemic, point to a general infection of the whole garrison at the very outset. If the disease had resulted from the preservation of germs in the property of Company M, or from the introduction of infected articles from any source, we should expect from the history of previous epidemics originating in a similar way, that one or more centres of infection would develop themselves from which the disease would gradually spread to other parts of the garrison. This was the case in 1873, when the disease first appeared in the post hospital. The removal of the command in this instance resulted in the protection of all who were removed.

An attempt was made by the editor of a Pensacola paper to show that the disease was introduced to Barrancas by soldiers of the garrison boarding the *Von Moltke* while she lay at anchor opposite the post; and this he very readily accomplished by inventing his facts. The broad statement was made that all the soldiers who were first taken sick had been on board the *Von Moltke* after whiskey, and there contracted the disease. Unfortunately for this theory, the commanding officer of Fort Barrancas ascertained most positively that no one from the post went on board the vessel. We are, therefore, reduced to the necessity of supposing that the yellow fever germs were sowed broadcast, by the wind which blew over the *Von Moltke* in the direction of Fort Barrancas, or that they were floated ashore by infected articles thrown over from this vessel, or that the disease originated at Barrancas *de novo*, independent of the *Von Moltke* or any other source of infection. This latter supposition has always been a favorite way of accounting for the origin of epidemics, both with the populace and with a certain proportion of the medical profession. It is a supposition which does away with the necessity for laborious investigation and careful consideration of

facts. But the more carefully the facts are observed, and the more thoroughly they are sifted, the more improbable the supposition appears. That epidemics result simply from "a visitation of Providence," may satisfy the ignorant. That they result from certain unknown atmospheric or telluric influences, sounds more scientific, but is no more satisfactory. But a solution of the problem is gradually unfolding itself to our view, which explains and comprehends all the observed facts relating to the origin and spread of epidemics of non-contagious diseases. This is the theory of living disease germs, capable, under favorable circumstances, of self-multiplication independently of the human body. It is difficult to believe that any local causes of disease exist at Fort Barrancas which are not found at Pensacola or the neighboring village of Warrington, or at other points on the Gulf coast. The post is located on an elevated sandy bluff. It is at all times thoroughly policed under the efficient regulations of the present commander, General J. M. Brannon. The locality is a remarkably healthy one, and exceptionally free from all endemic malarial diseases. It was exempt from visitations of yellow fever from the year 1853 until 1873, although the disease prevailed on the navy reservation in 1863, and again in 1867. Finally, a clear history of importation of the disease into Pensacola harbor has been made out for all previous epidemics (see "Report on Quarantine on the Southern and Gulf Coasts," by Harvey E. Brown, Assistant Surgeon U. S. A., pp. 35-39), and leaves it a matter of but little doubt that the epidemic of the present year would not have occurred but for the previous arrival in the harbor of an infected vessel, the *Von Moltke.*

Classification of Cases.

	No. of Cases.	No. of Deaths.		No. of Cases.	No. of Deaths.
Officers	2	1	Laundresses	7	3
Officer's wife	1	1	Laundress's children	19	4
Officers' children	4	2	Colored servant	1	
Enlisted men	40	18			

Total Cases, 74. Total Deaths, 29. Percentage of Mortality, 39.2.

Second Attacks. — After the removal of the command to Fort Pickens, there remained at Fort Barrancas for duty three officers and eleven enlisted men who had previously had yellow fever. Of these but two suffered a second attack, namely, Private Davis, of Company L, who had yellow fever at Charleston in 1858, and Private Allen, of Company A, who had a mild attack at this post in 1873.

Fatality. — The percentage of mortality was, in my opinion, considerably increased by the unfortunate circumstance that the removal of the command to Fort Pickens, while it resulted in protecting a considerable number from an attack of the disease, was very prejudicial to the recovery of those who were taken sick within a day or two after their removal into camp. The fatiguing labor involved in making the movement in so short a time; the fact that when taken sick the patient was necessarily sent over to Barrancas in an open row boat; and the circumstance that many of the men, from a

reluctance to come back to the infected locality, failed to report themselves sick until they were so ill as to be unable to hold out any longer, — together made a marked difference in the fatality of these cases. Among sixteen enlisted men who were taken sick at Barrancas, there were five deaths, or 31.2 per cent. While of twenty-two taken sick at Pickens during the five days following the movement into camp, thirteen were fatal, or 59 per cent.

YELLOW FEVER ON THE DRY TORTUGAS.

BY HARVEY E. BROWN, M. D., *Surgeon United States Army.*

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 12, 1874.[1]

THE great coral formation, known as the Florida Reef, which commences at Cape Florida on the east, terminates to the west in the Dry Tortugas group of islands. These keys are nine in number. The centre one, Garden Key, is sixty-four miles west of Key West, the nearest inhabited point, and is situated in latitude 24° 31′ 47″ north, longitude 82° 52′ 53″, west from Greenwich. Two miles west of Garden Key is Loggerhead, the largest of the group, an island about a mile long and one third in breadth, on which is situated a light-house. To the southwest, one mile from Garden Key, is Bird Key; to the south, Long Key; to the southeast, Hospital Key and Middle Key; to the east, about four miles distant, is East Key, and to the north, North Key.[2]

On Garden Key, the centre of the group of islands thus briefly described, is situated Fort Jefferson; it is a regular, hexagonal, bastioned work, inclosing a parade-ground of about nine acres and surrounded by a wet moat, and a massive sea-wall separating the moat from the Gulf; with the exception of a narrow strip of sand on the south, the whole of the key is occupied by the fort. The moat communicates with the Gulf by two waste ways, through which the tide ebbs and flows. The water in it is about five feet deep, and is occupied in immense numbers by various species of sea-urchins, anemones

[1] This brief abstract of Surgeon Brown's account of the epidemic at Fort Jefferson presents only the practical conclusions of his study of the events he witnessed; but his detailed narrative of those events and of the history of yellow fever at Pensacola, fully warrants the conclusions here presented. [EDITOR.]

[2] The climate of these islands is precisely similar to that of Key West. The monthly mean of the thermometer during 1873 was: January, 68°22; February, 70°65; March, 69°77; April, 75°95; May, 80°96; June, 83°23; July, 82°69; August, 82°79; September, 82°83; October, 77°04; November, 74°61; December, 70°94. This was the average of observations taken with an ordinary Fahrenheit instrument thrice daily, at 7 A. M., 2 and 9 P. M. The mean of observations taken with self-registering thermometers indicating the highest and lowest temperatures once daily, was for January, 66°90; February, 69°24; March, 71°40; April, 77°38; May, 82°20; June, 85°05; July, 83°96; August, 85°15; September, 84°23; October, 78°70; November, 74°; December, 71°20. The prevailing winds are from the north, northeast, east, and southeast, being from the north and northeast during November, December, January, and February; and during what may be called the epidemic months from the east and southeast.

and other marine animals. Within the fort are substantial quarters of brick, for officers and soldiers; these are three stories high, and well built. The hospital is in the same row of buildings as the soldiers' barracks, but separated therefrom by the unoccupied central portion of the building. Other structures inside are the light-house, the residence of the light-keeper, and two small cottages occupied by engineer superintendents. The embrasures of the work being mostly unfinished, the air has free access in every direction throughout the parade-grounds. Drainage is accomplished by means of a sewer of a horse-shoe form, extending around three sides of the fort, behind the officers' quarters and the soldiers' barracks. During the thirteen years' occupancy of Fort Jefferson, the yellow fever has twice prevailed as an epidemic in the garrison. It was epidemic in Havana during every year of the war, and in Key West in 1862–4–5, but did not make its first appearance at Fort Jefferson until August, 1867. The year 1867 was, as will be remembered, one of general epidemic prevalence throughout the Gulf region. The fever appeared in Havana and on the coast of Mexico at an unusually early period. The southern seaport towns were crowded with unacclimated whites, most of whom had recently been discharged from the army, and with negroes, who rejoicing in their new-found freedom, rushed from the country to overcrowd the cities. Both of these classes afforded food for the disease, living as they did in defiance of sanitary law and ignorant of the claims and necessities of the climatic conditions by which they were surrounded. The discharged imperial army of Mexico was straggling homeward, ragged, filthy, and moneyless, and appeared in force in many of the seaport towns of Texas and Louisiana, bringing with it the seeds of disease. The quarantine at Key West (the place having most direct communication with Havana) was but nominal, and the communication between the two places was frequent.

Hence it is not to be wondered at that yellow fever easily made its appearance at the various exposed points along the Gulf. The Tortugas, however, were exempt from these dangers; they were unvisited by strangers from infected towns, and had no open communication with any place except Key West, where the disease did not appear until after the arrival of the Spanish frigate *Francisco de Assis* and the English cable steamer *Narva* on the 31st August; both of which steamers had fever on board, but were, nevertheless, allowed free communication with the shore. . . . .

The epidemic was at its height on 2d September, and from that time declined for want of material, the only new cases after this date being three children in the family of the light-house keeper, and the unfortunate men who were so imprudently returned to Fort Jefferson after being sent to Loggerhead. In this way the epidemic was kept up with varying severity till the 20th of September, when the last case was reported. The last death occurred on the 6th October. The total number of cases was thirty-seven; the number of deaths fourteen, or 37.83 per cent.; one third of the total population being attacked, and about one seventh of them dying. . . . .

In concluding the report I desire to offer a few remarks concerning the question of the transfer or isolation of population from infected localities. This, to be sure, is no longer an open question; its advisability has been

proved in so many instances that it is only on the ground of accumulating testimony on its advantage that it is worth while to mention it. It is a curious fact in the history of yellow fever (and perhaps of other infectious diseases), that a community already infected may be moved from the locality where the disease first appeared; and that in its new and healthy location, no new cases will occur, except among those who were passing through the period of incubation at the time of such removal. In July, 1867, yellow fever was carried by a sick man from the town of Indianola, Texas, to the permanent military camp, distant a mile from town. Twenty-two cases and twelve deaths occurred, after which the command was moved to Green Lake, a healthy country locality some twenty miles distant. But two cases occurred after the removal, the remainder of the command keeping perfectly well, while a few soldiers, who had been left behind at the old post, all had the disease.

In the epidemic of 1873 at Fort Jefferson, the troops were removed to Loggerhead Key on the 28th August, a week after the disease had become epidemic. After removal, one man was taken at Loggerhead on the 29th, one on the 31st, and two on the 2d of September, all of whom were promptly returned to the fort, after which the disease ceased at Loggerhead, and the command there remained healthy. When the troops moved, several men remained behind at the fort; all but one of these took the disease, and that one was the ordnance sergeant, who lived in a distant part of the work, and held no communication with other parts of the fort.

The removal of the sick to a distance, leaving those who have not been attacked behind, was shown to be of no value in the epidemic of 1870, on Governor's Island, New York Harbor; cases of the disease continuing to occur for a month after the sick had been so moved. This absence of disposition to spread (as we may call it), has always been used as a strong point in favor of the non-infectious nature of the disease, but a little consideration will show the fallacious character of the argument. The conditions in the two localities are entirely different. When the fever breaks out among troops in forts or permanent barracks, its germinal principle quickly infects the walls, wood-work, and furniture of the quarters. Moreover, within the walls of a fort or in barracks, there is always a certain amount of residual air, which the ordinary wind-currents are not sufficient to entirely remove. This speedily becomes charged with the poison, and thus resembles that contained in the infected hold of a ship, producing the disease in all susceptible persons who respire it. Let, however, the population of such an infected locality be removed into tents in an open country, and all these deleterious conditions disappear. The tents should be so arranged as to afford a frequent and complete renewal of the atmosphere; if they become infected, they and their contents should be immediately destroyed.

We may lay it down as an established fact, that the cessation of yellow fever and its inability to spread after removal of the well people from a locality where it exists, so far from being any argument against its infectiousness, is really one in favor of it, for this reason, where the *sick are moved instead of the well*, as at Governor's Island in 1870, the epidemic continues, all the conditions for its propagation being still present.

VI.

PUBLIC HEALTH LAWS AND SANITARY ADMINISTRATION.

PHARMACY IN ITS SANITARY RELATIONS.

By JOHN M. MAISCH, *Philadelphia*,
Permanent Secretary of the American Pharmaceutical Association.

READ AT THE ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 12, 1874.

The subject which the writer discusses in this paper is of vital interest to every individual. Regardless of age, sex, or station in life, every one is, to a greater or less degree, dependent upon pharmacy and its followers for the restoration or preservation of his health. Not only when a physician is called in to prescribe for the sick, is the safety of the patient intrusted to the pharmacist's hands; but almost daily has he occasion, in the legitimate pursuit of his profession, to use his business capacity or his practical and scientific knowledge for the weal or woe of his fellow-man. It is not merely the possibility of making an oversight or mistake, involving the life or health of his customer; but it is almost altogether a question of his positive knowledge, and of his capability to recognize the crude drugs, to judge intelligently of their quality and purity, to convert them properly into the various galenical preparations and extemporaneous compounds, to preserve them unaltered for the longest period, and to ascertain promptly even the incipient deteriorations, particularly if tending to affect their curative powers; of no less importance is his knowledge of the average adult doses in which medicines are employed, and — in general terms — of their medical properties.

The habitual exercise of ordinary care and circumspection will, at an early period of his professional and business career, be regarded by the pharmacist as his paramount duty; and if this be well understood, suitable precautions will be taken in all the varied duties pertaining to the laboratory or the office. Of the errors and mistakes occasionally occurring in pharmaceutical stores, — more frequently, it is believed, in bygone days, — a very small number only are directly and solely attributable to want of proper care. While it is true that culpable negligence exists in some stores, it will be found that mistakes occurring in consequence thereof, in nearly every instance, might have been avoided, if the guilty party had possessed sufficient

knowledge of the physical properties of the article, and been able to recognize and distinguish it from others of similar appearance. Man is liable to err, and the pharmacist forms no absolute exception to the rule. His training — commencing with his apprenticeship, and continuing until the close of his business career — is directed towards the avoidance of errors and mistakes by himself, and their detection, if committed by others, be it in the incorrect label attached to the purchased drug or chemical, or in the incorrect name or the overdose ordered in a prescription. Continued watchfulness being an acknowledged and well-understood necessity in his business, it soon becomes a habit with the pharmacist; and hence cases of error solely from inadvertence, preoccupation of mind, or similar causes, are rare. On close examination, it will be found that nearly all mistakes occurring in drug stores should be charged to a want of or to insufficient knowledge, as a careful analysis of the published cases of druggists' mistakes which have occurred in this country, will show. While, on the one hand, it must be granted that a proper education for his profession is requisite as the means of reducing the liability of the pharmacist to make mistakes, to a minimum which — though a condition of human nature — will, by an unceasing watchfulness, be reduced *almost* to an impossibility; on the other hand, it must be obvious to all that the public is equally interested in the qualification of pharmacists, as far as a knowledge of quality of drugs, and all medicinal preparations, is concerned.

There was a time when, in Europe, medicinal articles were manufactured especially for the American market, which could not be sold there, but were considered good enough for this side of the Atlantic. And it must be admitted that thirty years ago the United States furnished a much better market for adulterated, inferior, and worthless drugs, than at the present time. In 1848 Congress passed a law, which is generally designated as the Drug Law, providing for the appointment of drug examiners at the various ports of importation, whose duty it was to examine all drugs and chemicals imported from abroad, and to reject the deteriorated and adulterated. This law has had a very beneficial effect in excluding from our markets many inferior and valueless articles, and its operation would doubtless have been still more satisfactory if the appointing power had always considered the scientific and practical qualifications of the candidates rather than their political services. It cannot be denied that some of the drug examiners, appointed during the twenty-six years of the operation of this Drug Law, were totally unfit for the position, not being able to identify or judge of the quality of drugs in every-day use, while others were thoroughly qualified, and discharged their occasionally disagreeable duties without fear or favor. The importance of having the right men in the right places was recognized at an early date by the American Pharmaceutical Association, which, in fact, was organized after an exchange of views on the Drug Law had been had by the representatives of pharmaceutical bodies; and in the year 1852 that association passed the following resolution, which, however, had very little, if any, effect: —

"*Resolved*, That inasmuch as the usefulness of this law will be propor-

tioned to the ability and conscientious discharge of duty of the examiners, that this convention shall respectfully and urgently represent to the appointing power the cardinal importance of preventing the removal of qualified examiners on mere political grounds."

But notwithstanding the drawbacks pointed out in reference to the retaining of qualified examiners, and some other defects of perhaps minor importance, this law has been one of the most important means of improving the drug market of this country, by excluding inferior and worthless articles from it. In older countries, where pharmaceutical matters are better and more effectually regulated than with us, foreign drugs of all descriptions and varieties may be met with in the market, and no doubt ultimately are put to some use, which does not entail too large a loss upon the importer, although it may be to the direct detriment of the consumer. In those countries the pharmacist is, by stringent laws, made responsible for the quality of his drugs and preparations, whether they be imported or of home production. With us the responsibility of pharmacists is regulated mainly by common law, and is based upon the amount or degree of harm done. Our national Drug Law, by the manner in which it is executed, is not able to totally exclude inferior drugs from entry; and, if once entered, from consumption; it cannot reach the cases of home adulteration, which properly should be referred to the police regulations of the individual States, and which at present are, in most States, merely liable to respond in an action for damages, while in reality the responsibility should attach to the quality. The Philadelphia Pharmacy Act of 1872 makes it a misdemeanor "to mix or cause to be mixed with any medicinal substance, any foreign or inert substance whatsoever for the purpose of weakening or destroying its medicinal power or effect, or to willfully, knowingly, or fraudulently sell the same for medicinal purposes;" the penalty being a fine not exceeding five hundred dollars, and the confiscation of the adulterated articles. The need of a similar law has been felt in Great Britain, and resulted in an Adulteration of Food Act, passed by Parliament three years ago, which, however well-intended, appears to be too crude and indefinite for its adoption to be recommended for us. The improved condition of our drug market is only in part due to the operation of the inspection law, cited before; the main cause of this improvement is the progress of popular intelligence in general, and the increased educational facilities of the pharmacist in particular. Our market now furnishes as good drugs as can be found elsewhere, and that they meet with a ready sale is evidenced by the quantity imported, and the number of wholesale houses keeping them on hand. Yet the question may be asked here, as well as in other countries: What becomes of the second and third-rate drugs? To the experienced, this question is not very difficult to answer, as far as our country is concerned; there are many ill-informed apothecaries in small and large places, and many medical practitioners in the country, furnishing medicines to their patients, who possess little or no knowledge of drugs, and who are willing to purchase, provided the article be a little cheaper than it can be obtained from another house. These are the main, or perhaps the only outlets for the cheap and inferior drugs.

The cheapness of so-called officinal medicinal preparations is always an argument in their favor on the part of the same class who purchase crude drugs because they are cheap, and who are little influenced by the reflection, that a galenical preparation cannot be sold at a less price than the cost of the articles which are pretended to enter into its composition. There are now perhaps several hundreds of so-called manufacturing pharmacists in the United States, some turning out unobjectionable products as far as quality is concerned, while the products of others are inferior and unreliable, all however, having the tendency to encroach upon the legitimate vocation of the pharmacist, and to aid in closing the laboratory of the latter. This state of things has not come suddenly upon us; it has gradually grown from insignificant beginnings and its existence is due in part to the ignorance or indolence of a certain class of pharmacists, and in part to the support received from many members of the medical profession. It is not uncommon for physicians to prescribe A's extracts, B's fluid extracts, or C's pills, instead of insisting on getting these articles, if officinal, prepared so as to represent the intention of the pharmacopœia; and if favorable results have been obtained with such a preparation, a history of the case may sometimes be found in the medical jounals, with the manufacturer's name attached in such a manner, as to lead unthinking practitioners to infer that peculiar virtues are connected with a preparation, because it had been made by or under the supervision of a certain man. Another circumstance has contributed to increase this evil. Though justifiable perhaps from a purely commercial standpoint, the publication, by manufacturing pharmacists, of so-called medical journals, is detrimental not only to the progress of medicine and pharmacy, but likewise to the best interests of the public. Donning a professional garb, they are usually filled to a considerable extent with reports of cases benefited or cured by one or more of the special preparations of the manufacturer, and being obtainable for a mere nominal price or even distributed gratuitously, such journals find their way to just such places where a demand for their owner's preparations can be created or increased. Suppose that this movement has been inaugurated with what may be regarded as perfectly legitimate preparations, it is soon followed by so-called *specialities* and *elegant pharmaceuticals*, which are imposed upon the physician and the public, and which, though their composition is stated with an appearance of frankness, in too many cases scarcely differ from the vile nostrums, which no true physician would prescribe and with which every upright pharmacist would refuse to have his name connected.

And has there been nothing done on the part of pharmacists to counteract this increase of semi-secret medicines and of preparations sailing under false colors? We believe that a good deal has been accomplished or at least attempted. Some of these compounds have been examined years ago, and upon the result of the analysis their advertisements were promptly banished from the columns of the few pharmaceutical journals of our country, while at the present day, the advertising pages of many medical journals are open to them, simply because they have not the appearance of nostrums. In some cities, the prescribing of elixirs of different makers had become such

a nuisance, that pharmacists were compelled to keep in their stores half a dozen different preparations all bearing the same name, to gratify the whims or predilections of the prescribers. Several local pharmaceutical societies endeavored to create order in this chaos, and devised and adopted formulas to meet the apparent demand, but met with rather indifferent success. The American Pharmaceutical Association, with the view of overcoming the difficulties, adopted a series of formulas for these preparations in the month of September, 1873, and they were communicated to the secretaries of all the medical societies throughout the United States; yet the answers received did not exceed six in number. This apparent indifference is to be deplored; but how can it be remedied? The formulas may perhaps not be the very best that can be devised, or that meet the taste of the largest number of patients; but it was a move in the right direction in so far as it attempted a uniformity in composition and reliability of a large class of preparations throughout the United States.

This subject brings us to the so-called patent medicines, the preparation of which is kept secret, but whose pretensions are, for that very reason, without bounds. It is not our purpose to inquire whether the largest number and the most successful ones have been originated by physicians, pharmacists, or totally ignorant pretenders; nor do we intend to compare the number of physicians prescribing one or more, with the number of pharmacists advertising themselves as agents, or pushing their sales by almanacs, handbills, and show-cards. The evil exists; the easy *noli me tangere* way of bygone days is no longer justifiable; the infant is fed with "soothing" and "teething syrups," containing morphia and laying the foundation of a taste for opiates in maturer age, if that should ever be reached; the "golden pills" and "female mixtures" invite directly to the crime of abortion by cautioning females not to use them while in the state of pregnancy; the victim of syphilis finds his constitution totally shattered after *curing* his vile disease by the free use of mercurial preparations, which are *warranted to be free from mercury and other poisonous drugs;* the poor consumptive imagines his hacking cough relieved by the "unfailing cure for consumption," when the tartar emetic contained therein merely hastens his unavoidable dissolution before the disease had run its natural course. There is scarcely a nostrum which is not calculated to do infinite harm, be it in consequence of the powerful medicines contained in it, or because of its injudicious use by the public. Various measures have been proposed to counteract the bad effects of secret medicines. The most radical and effective cure would be their total abolishment, if this were possible. The writer is not an advocate for prohibitory measures generally, and as far as this particular case is concerned, he believes that the experience of Germany and some other European countries has proved their ineffectiveness. The French plan of registering the formula for the medicine with a central medical authority and imposing heavy fines upon any deviation therefrom, invests the preparation with a certain recommendation, which goes far towards gaining for it the confidence of the public. Perhaps the least objectionable plan, if that could be accomplished, would be to compel the manufacturer to have the full com-

position or working formula plainly printed upon the label of every package. It must also be borne in mind, that in a country like ours, there must naturally exist a necessity for domestic medicines, because outside of the cities and the more populated districts, it is often impossible to secure the services of a physician except after hours of delay. This demand seeks to be satisfied, and since it has not been done in a professional way, every pretender finds an open field for his enterprise and luck. Many years ago, the writer heard from the lips of his lamented friend, the late Professor William Procter of this city, a proposition — whether original with him, he is not prepared to say — which has been recently advanced from other parts, and seems to be eminently qualified to displace most of the nostrums; we give it in the plain language, in which it was put, about a year ago, by the "Atlanta Medical and Surgical Journal": "In the way of *remedy* for these acknowledged evils, we suggest that the medical profession recognize the want of household remedies by publishing *authoritative formulæ* for the use of pharmacists, who may compound them at their counters and keep them on hand for the ready and convenient supply of *all the real wants* of families and of individuals in this direction."

Such a measure would go far towards abolishing a large number of nostrums; but it would be advisable not to neglect the direct instruction of the public by furnishing tracts on sanitary subjects either at a mere nominal cost or for gratuitous distribution; by the delivery of popular lectures, devoid of technicalities, and by instructing the more advanced classes of our public schools in the means of preserving health and in the dangers of the injudicious use of all drugs. Dr. F. Hoffmann of New York has recently, in the "Chicago Pharmacist," pointed out a way by which the public can be readily reached, which has much to recommend it: He suggests that some enterprising publisher arrange to annually edit a publication containing generally useful information and statistical notes about sanitary and health matters and requirements; brief directions for the prompt application of antidotes to the common poisons in daily use in domestic economy, in arts and trades, first help in accidents and emergencies, popular essays on the absurdities and dangers of the nostrum traffic and its origin; the composition of nostrums which have been analyzed, etc., etc. The cost of such a publication might be covered by the pharmacists subscribing, with the view of distributing gratuitously, for any number desired; their business card might be inserted upon the cover.

The author has endeavored to give, in a few hurried strokes, a sketch of the relation of pharmacy in the United States to public hygiene. To complete it, it is necessary to state that there are about ten institutions in the entire country devoted exclusively to the education of pharmacists. Whilst this number is inadequate, it is well to point out how necessary it is to exercise due caution in the establishment of new schools, so as to avoid errors, the deplorable effects of which have made themselves felt in other professions. To judge from the circulation of the journals devoted entirely or partly to pharmacy, at least one half of all the pharmacists in the United States do not read any pharmaceutical periodical, but lag behind in this age

of uninterrupted progress; a sad commentary on the proposition with which we started, that the pharmacist's qualification for his vocation is shown in his positive knowledge. Good and reliable pharmacists may be found in most places; the pharmaceutical colleges have done their best to prepare those presenting themselves for instruction; yet many cannot avail themselves of the opportunities offered, while others have at least heretofore felt indifferent, although they had the facilities before their very doors. It is, therefore, fair to ask the question, whether the pharmacists have felt their responsibility, and whether they have done anything towards bettering the condition of pharmacy and securing to the public greater protection from the dangerous results flowing from ignorance and superficiality. In answer to this it is proper to state that in 1867 the American Pharmaceutical Association urged upon our legislators the importance of a judicious but definite, determined, and, as far as practicable, uniform control of pharmacy in the various States; and offered the services of its officers to the State Legislatures and constitutional conventions, whenever the coöperation of the Association might be deemed desirable or useful. This resolution was communicated to the Governors and the presiding officers of the Legislatures of all the States in the Union, and in 1868 a report was laid before the Association, containing copies of and reviewing critically all the laws relating to pharmacy in the United States which could be collected. This report resulted in the appointment of a committee directed to draft a law to be submitted to the various States, which was accomplished in 1869, and copies of the two reports were sent to the Governors, Legislatures, and leading Judges of all the States. Since that time a committee of the American Pharmaceutical Association is annually appointed for the purpose of collecting the laws relating to pharmacy, which may be enacted, and if necessary, of coöperating with the proper authorties. The reports of this Committee, together with the laws, are published in the Annual Proceedings of the Association.[1]

[1] The following is a brief abstract from the documents mentioned: In two of the States, Georgia and Alabama, there are old laws on pharmacy which were long allowed to be dead letters, but are now beginning to be enforced; the granting of licenses to apothecaries upon their standing a satisfactory examination as to their knowledge of drugs and pharmacy, is made the duty of medical boards.

Besides the pharmacy laws which, since 1870, were introduced in the legislatures of ten or twelve States, but which failed to pass for various reasons, during the last five years, laws intended to regulate the practice of pharmacy have been enacted in the following States: —

Rhode Island, 1870 and 1871, applying to the whole State; board appointed by the Governor.

Maryland, 1870 and 1872, applying to Baltimore City; board appointed by the Governor upon the recommendation of Maryland College of Pharmacy.

New York, 1872,* applying to New York City; board appointed by the New York College of Pharmacy.

Pennsylvania, 1872, applying to Philadelphia City; board appointed by the Mayor.

California, 1872, applying to County of San Francisco; board appointed by the California Pharmaceutical Society.

Ohio, 1873, applying to cities of the first class (of 175,000 inhabitants); board appointed

* In 1871 a pharmacy bill was passed, which was so obnoxious in its provisions that it was repealed the following year.

As a general rule the laws have been cheerfully complied with; in a few places prosecutions had to be instituted under these laws to enforce compliance. In the city of Philadelphia this has thus far been neglected, there being, as we understand, a difference of opinion in regard to the proper officers to commence legal proceedings. Full reports of the proceedings of all the pharmaceutical examining boards have not been published; however, from private information and from the few published reports, the number of rejections by the boards may be computed to be about twenty per cent. of all the applicants. Within a few years two important laws were passed relating to the sale of certain medicines. The law of Pennsylvania, approved March 16, 1870, is entitled "An act to prevent and punish the publication of obscene advertisements, and the sale of noxious medicines," the former referring to publications relating to the cure of venereal and of female diseases, the latter to the selling or keeping for sale of so-called female medicines and of medicines and instruments for procuring abortion, etc. This law is practically a dead letter, no prosecutions having taken place under it, and forbidden advertisements being found in a number of newspapers.

The Illinois law, approved March 27, 1872, is entitled "An act to prevent the sale of drugs or medicines designed to procure criminal abortion." It forbids the sale of ecbolic and abortifacient medicines except upon the prescription of a physician, and no compound intended for female complaints is allowed to be sold, unless five well-known and respectable physicians of the county have testified under oath, that it is not of an abortifacient character. This law is likewise entirely inoperative.

Provisions regulating the sale of poisons are incorporated in several of the Pharmacy Acts referred to above, and in most States special laws are in force, but nearly all inoperative. The laws generally provide for a registration of every sale of poison, the list of poisons in many cases being incomplete or very inaccurate. It is very difficult to suggest a plan by which a general compliance with the regulations of these poison-laws can be secured; the vague direction of some, that these registers shall be open for

by the Court of Common Pleas, from nominations made by the incorporated College of Pharmacy, or Pharmaceutical Society.

Missouri, 1874, applying to St. Louis City; board appointed by the St. Louis College of Pharmacy.

Kentucky, 1874, applying to towns and cities of 5,000 or more inhabitants; board appointed by the Governor, from nominations by the Louisville College of Pharmacy.

These new pharmacy laws resemble each other in this respect, that they require of the proprietors of stores (and some also of the assistants), a practical and theoretical knowledge of pharmacy and its collateral branches, which is determined by an examination before the Pharmaceutical Examining Board. Upon passing this examination a certificate is granted, entitling the holder thereof to practice pharmacy, either as proprietor or assistant in the city or State in which it has been issued. Graduates of the recognized pharmaceutical educational institutions in Europe and this country are registered without further examination. The boards are composed of pharmacists, — New York requiring that three of the five pharmacists constituting the board shall be graduates of some legally constituted medical college, the remaining two of a pharmaceutical college. The New York law is the only one permitting the registration, without examination, of physicians to act as pharmacists.

inspection by police officers or by physicians, amounts to very little; but on the whole, I think it will be found that the higher the qualification of the pharmacist, the more effectual will be his precautions, not only in the sale of poisons, but also for their storage in his establishment.

From whatever standpoint we may look upon American pharmacy in its relations to public health, we shall find that the speediest, most effectual, and to the public, least expensive method of securing all the advantages that may reasonably be expected from it, in health and in sickness, will be to insure the proper qualification of the pharmacists. This is one of the main purposes of the local pharmaceutical associations and also of the national representative body of pharmacists; to accomplish this, among kindred objects, these societies have earnestly labored for years, and in their efforts deserve the support of all who have at heart the welfare and safety of the public.

Since the above paper was read before the American Public Health Association, the following additional pharmacy laws have been enacted in the United States: —

New Hampshire, 1875, applying to the whole State; board appointed by the governor.

South Carolina, 1876, applying to the whole State; two boards, appointed by the South Carolina Pharmaceutical Association and by the medical colleges at Charleston and Columbia.

It should also be noticed that a Popular Health Almanac, edited by Dr. Fred. Hoffman, has been published by E. Steiger since 1876.

THE ESSENTIAL CONDITIONS OF GOOD SANITARY ADMINISTRATION.

By DORMAN B. EATON, LL. D.,
Chairman of the U. S. Civil Service Commission.

A DISCOURSE AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 9, 1875.

SANITARY administration is relatively good when on the level of the general intelligence, but is absolutely good only when it accomplishes whatever is within the power of government reasonably exercised to promote the health and preserve the lives of a people. Such administration implies and must be sanctioned by judicious and comprehensive sanitary laws.

What, then, in this country are the essential conditions of such administration? I answer, the following three, and I propose to offer a contribution in aid of securing them: —

1. That a majority of the people, or those whose advice this majority will follow, have an adequate conception of the true meaning and scope of sanitary laws and administration.

2. That such majority, or its accepted advisers, have faith in sanitary precautions and adequate knowledge how to devise and apply them.

3. That effective methods in harmony with our constitutions, social conditions, and ideas of justice and policy, be provided by statute for securing the coöperation of persons of the most instructed intelligence and the highest *sense* of public duty, in aid of such administration.

These conditions, true theoretically, will be found equally true when considered in reference to the present condition of sanitary intelligence, faith, and administration in this country.

No competent judge, I venture to think, can look into the crude, shallow, arbitrary, and heterogeneous mass of laws and ordinances which are nominally in force in a majority of the municipalities of this country, or compare the statutes recently enacted in various States for creating State Boards of Health, without being painfully impressed with the conviction that the conditions named exist only among a small portion of the people of the United States. Indeed, were it not for the growing spirit of inquiry among the people on the subject of public health, for the more comprehensive legislation and the larger supply of pecuniary means to that end during the last few years, and especially were it not for the enlightened zeal and self-sacrifice of the medical profession, all of which this Association has promoted, and the last of which it nobly illustrates, in aid of sanitary reform, — the actual condition in many quarters would be as discouraging as it is disgraceful. In not a small proportion of the States, the condition of the law and administration on the great subject of the public health, and to a large ex-

tent on the subject of general morality and prosperity, as dependent upon the public health, is far behind that of the more enlightened states and nations, and is discreditable to our institutions. We must, in view of it, adopt one of these conclusions: either that the majority of the people do not know how great a portion of the premature death and sickness and discomfort among them could be prevented, and how much in other places has been prevented; or else, that they are alike indifferent to health, comfort, and life.

And even when sanitary legislation and administration, more or less satisfactory, have been secured, there is such an absence of any common method — such contrariety of aim, scope, and authority, — as indicates pervading immaturity of thought, and calls for an examination into the first principles of sanitary administration.

Even the municipal health laws of New York City, which are the earliest and best in the country, while in some particulars superior to any elsewhere, are yet defective as compared with those relating to several European cities. So the laws creating a State Board of Health in Massachusetts, though they are the earliest, and perhaps the best of the kind in the Union, are yet very feeble and defective as compared with those in force in Great Britain. And perhaps the people of Georgia may have good reason to think — if it shall be well administered — that their law, enacted during the present year, and of which large portions are taken from the health laws relating to the City of New York, is even more comprehensive and enlightened than that of Massachusetts. It is certainly greatly superior to the act creating the State Board of Health in Minnesota, and is beyond all comparison with that moribund pretense of sanitary legislation in Virginia, which at once illustrates the zeal of the medical profession and the lamentable parsimony of its legislators in regard to a subject which vitally concerns the intelligence and prosperity of that venerable State.

But criticism will be more intelligent and appropriate after we have considered some facts and principles. What view, then, shall we take of the scope and aim of sanitary administration?

1. In trying to secure longer life and more comfort and health in our relations with nature and each other, we no more ignore Providence, or attempt to improve upon it or nature, than when we send for a doctor, cook raw meat, or prepare warm clothing and a fire against cold weather, or when we deepen the channel of a river, or grade a roadway track to secure easier and safer transportation. The fact that we are placed in peril of storms and pestilences and miasmata, is no good cause for not using our reason to the best advantage for securing good ships, good doctors, good medicines, good food, and good sanitary laws. But the arguments that sickness and death, as they occur, are providentially inevitable, and that pestilence and famine are preordained messengers of God's wisdom and wrath, before which we must dismiss our reason, — that our precautions against them are vain floutings of our wisdom in the face of divine Providence, — are so nearly monopolized by illiterate grandmamas and superannuated bigots, as to be elements of precaution hardly worthy of notice in our sanitary condition on

earth. Though Dr. Lyon Playfair, now a professor at Edinburgh, says that in his day Scotch professors dared not preach such heretical doctrines, and it is not very long since an English company was refused the liberty of deepening the channel of the Guadalquivir, because, as it was argued, if God had intended the river to be navigated, He would have made it navigable.

2. We no more assume that human beings can always be preserved in health than that their earthly existence can be made immortal. We no more propose that the hand of the State or the precept of the law shall, at all times and everywhere, assume to instruct or to direct as to our health than as to our habits or our industries; but that, equally as to each, the coercion of the law shall be felt just when and where and to that extent that a sacrifice of individual interest and preferences will, in harmony with our republican system, promote the general welfare. We ask no new constitutional power, and no surrender of individual rights, but only a true application of old principles in a clearer light, in a wider sphere, and for the achievement of a higher good, than heretofore.

Let us consider, then, what in general within such limits the State may properly do to protect life and promote health: —

1. The same divine or human law which says "thou shalt not kill" directly, says thou shalt not kill indirectly, — thou shalt not kill by quackery, nor by nostrums, nor by poisoning the air or the waters which the Creator has prepared as a blessing for all his children; thou shalt not kill by neglect and ignorance, which are a violation of your duty as a man or a citizen.

2. The same law which rightfully enjoins you not to deceive or misrepresent or defraud in common bargains about peanuts or clams, ought to require, and does in principle require you not to assert falsehoods about medicines; not to claim a medical skill you do not possess; not to put unwholesome foods or drinks upon the markets; not to construct an unsafe bridge, or an undrained or unventilated house.

3. Any theory of the duty of a State, or of the sphere of legislation, which justifies the taking of public money for teaching men or children how to read or write, or to practice agriculture, or any trade, or how to kill human beings rapidly on sea or land, also authorizes the promotion of that special knowledge which enables human beings to live long in health and vigor in this world, and which secures the most men who are fit to fight and to work, and the most women who can walk a mile, or mount a flight of stairs, or are capable of being the mothers of healthy children.

4. There is no sound policy or principle of the Constitution according to which it is the right or the duty of the State to build poor-houses, jails, and asylums, without at the same time having the right and being under obligation to take all reasonable sanitary measures for securing that cleanliness and purity of home life and that physical as well as mental health, the measure of which in every civilized country determines the cost and the inmates of these institutions.

5. By no process of reasoning can it be shown that you may legally and usefully take my land to give a convenient course to a road, or tax me to

grade a highway, so that my neighbor's horse may draw a larger load of potatoes, or forbid me, in a city, to build my house of wood, or take my lot for a park or a cemetery, but that you have not, at the same time and and for better reasons, the right and the duty of requiring the drainage of swamps and pools and the cleansing or removal of filthy slaughter-houses and noisome manufactories and manures and cesspools, which bring miasma, disease, poverty, and death upon villages and cities.

6. Is it not too plain for argument, that if the law may treat me as a trespasser if I put my foot on my neighbor's grass, or hold me liable if I pour my slops into his yard, or allow my pigs in his garden, that the law and the judges may and ought also to hold my neighbor responsible if he allows noxious exhalations from his pig-sty to make my house uncomfortable, gases from his furnace to blast my trees or inflame my lungs, or poisons from his factory to make unwholesome the clear stream and the pure air which are the solace and the life of thousands.

7. If the State and the nation may legally or wisely — and who doubts they may — take the money of the people to ascertain and record the pigs and the peas, the grass and the geese, the cloth and the cheese which the country produces, — may prognosticate whether it will rain or shine to-morrow, and inform Flora McFlimsey whether she will need an umbrella, — may tell us how many Chinese vex the Californians, and how many Irishmen come over here to vote and to prosper, — what number of young girls at forty are unmarried and what number of young fellows of seventy marry girls of seventeen, — surely either State or nation may provide for a full record of the times and the number of births, marriages, and deaths, — those great events of life which, above all others, are full of instruction and admonition, illustrating, as they do, the prosperity and the health, the medical skill, the legislative wisdom, and the morals of a people.

In short, if in government there be any end which (next after religion and morality) justifies all rightful and constitutional means, it is the end which is represented by a race of vigorous, long-lived, healthy, moral human beings, which sanitary administration tends powerfully to produce ; and therefore, if any fit means to that end be not constitutionally prohibited, they are alike justifiable, and to be acknowledged and favored.

Stated more specifically, sanitary laws may therefore extend to the following subjects : —

1. To the gathering and dissemination of that kind of practical and instructive knowledge relative to the preventable causes of disease and death, and to the cure of sickness, and the building up of the physical system, which, while stimulating individual effort in the same direction, affect the public at large, and cannot be, and are not likely to be, secured by any private effort ; and to these ought to be added original and thorough investigations into the science of public health (such as England is causing to be made), to which the world is so much indebted, and which may be made a blessing as valuable and universal as any work which a State can foster.

2. To securing a systematic and complete registry of births, marriages, and deaths ; of the particulars of contagions and epidemics, and the other

more prevalent and dangerous diseases, and of accidents causing death and inability to labor; whereby life-saving medical knowledge is enlarged and enlightened; the effect of the wisest efforts to protect life and health are brought to a practical test of usefulness; the fatal and bloody secrets of abortionists and corrupt coroners are opened to the light; child murder and secret assassination, and deadly quackery are exposed; land titles, the marital relations, and paternity are made more secure; in short, whereby a nation, and each community in it, is brought face to face with the ugly but admonishing evidence of its ignorance and immorality, and there is provided for posterity the most instructive evidence of past civilization.

3. To securing the highest standard of education and moral tone in the medical profession; but for administrators under laws having such aims, the most suitable members of that profession should be sought, and the pride and sense of duty, which are its honor, should be made the main reliance, as they are to be the great inspiration.

4. To better safeguards through publicity, tests, and penalties, against nostrums and charlatanry, — more fatal and costly than the afflictions they pretend to cure; and to the publication of are liable pharmacopœia, as is now provided for in England.

5. To providing more severe and certain responsibility on the part of all those who, for love of gain, by negligence, falsehood, or design, make light of, or bring peril to human life, or the health or safety of a people.

6. To all practical measures for securing pure water, pure milk, pure air, and wholesome food; and to this end providing for tests, *inspections*, and penalties which can be promptly and easily enforced and collected.

7. To securing good drainage about villages, and good sewerage in all public streets; and in connection with all public buildings; for the want of which thousands now needlessly sicken, and many die.

8. To adequate ventilation in schools, colleges, hospitals, asylums, court rooms, theatres, public halls, tenement houses, and in any other places used for like public purpose; so that no longer, as now, they shall be the source of universal discomfort and frequent disease.

9. To vaccination in that effective manner which shall disarm both prejudice and peril, and to providing safe vaccine matter, and perhaps other safe and simple medicines for the very poor; and public baths and urinals for general use.

10. To those disinfections and purifications which so generally arrest contagions, and so much limit epidemics.

11. To the regulation and, if needful, to the removal or suppression of occupations and practices dangerous or detrimental to the public health, and to the removal of garbage, offal, and other filthy matter; with suitable provisions for making the expense a lien on property, and a personal charge against those guilty of neglect; and in this regard the *provisions* in force in the City of New York are the best in the country, if not in the world.

12. To the inspection, by the sanitary authorities, of all hospitals, asylums, prisons, schools, and other public buildings and premises, which are within the range of the sanitary laws; and such inspection of private build-

ings, in presence of epidemics, as may be necessary to protect the public health.

13. To providing for instruction in the art of nursing, to at least that extent which shall secure duly instructed nurses for all asylums, hospitals, and other like public institutions.

14. To preventing over-work, and abuse and neglect of children, as far as practicable, without undue invasion of private rights and the *sanctities* of home.

15. To the supervision of dead human bodies, and to cemeteries, burial grounds, disinterments, inquests, dissections, and morgues.

16. To such provisions as to the width and distances apart of city streets, and the size of city lots, as shall facilitate the erection of separate, small houses for those of small means, and tend to keep them out of large tenement houses; and also to rigid requirements as to the height, light, sewerage, and ventilation of buildings offered for rent to the poor; it being in part a consequence of the ground-plan of the City of New York that (so unlike Philadelphia) nearly half her people are in tenement houses.

17. To provisions which shall secure rapid and cheap transit for the poor, so that they may live beyond the densely populated parts of cities, and work within them.

18. To all this must be added, in places where needed, the usual quarantine authority, for preventing the introduction of disease through foreign vessels and external commerce; and also that broad, discretionary power necessary in boards of health, of acting promptly and fearlessly, for subordinating private comfort to public safety, and for making all needful expenditures to avert and alleviate pestilence.

Such, generally stated, are the sphere and aim of sanitary administration.

The organization and methods best adapted for the exercise of such authority, I shall hereafter consider.

If the cause of sanitary reform had to appeal only to those who take part in this Association, or, indeed only to the tens of thousands of intelligent, benevolent, and patriotic men and women scattered all over the land,— whose prayer and example are its strength and hope,— there would be no need to show that such legislation is practicable and perfectable for a people; but millions who vote are not only without the elements of sanitary knowledge but are without the necessary faith in those who possess it. It is plain that the work never will be adequate until the majority are further enlightened.

Let me refer them to some of the reasons why it is plainly practicable, as well as our interest and our duty, to secure good sanitary administration in this country.

It may be freely admitted, that Egypt, India and China, and Assyria, were populous and powerful; that Alexander conquered, that Greece and Rome blossomed in art and literature, and fell; that Christianity lighted up a heathen world, and with civilization steadily advanced,— without sanitary administration in that broad sense, or with that beneficent spirit, which

the better part of this generation demands. But it would be a great mistake to assume that in ancient or mediæval times, sanitary precautions were in cities or villages even wholly neglected; or that they were in large measure neglected without a fearful retribution.

In the Code of Menu, believed to be older than any part of the Bible, the duty and utility of purification and cleanliness are plainly stated, and in many chapters of the Pentateuch, we are taught the same lesson. Inscriptions from the ruins of Assyrian cities imply sanitary precautions; and modern excavations prove that *cloaca maxima* were under the cities on the Euphrates before they were under those on the Tiber. On the Bellini Cylinder of Sennacherib it was found that an Assyrian king had inscribed these words: "Of Nineveh, my royal city, I greatly enlarged the dwellings. Its streets, I renovated the old ones, and I widened those which were too narrow. By my care, I caused the uprising of springs in more than forty places in the plains." Homer was a true sanitarian and practiced disinfection, for he says: —

> "Bring sulphur straight, and fire, the monarch cries.
> She hears, and, at his word obedient, flies;
> With fire and sulphur, — cure of noxious fumes, —
> He purged the walls and blood-polluted rooms."

Hercules, also, was a sanitarian, and believed in cleansing and draining; for he saved the Elians by draining their swamps, and made himself useful and immortal by cleansing the Augean stables. Plutarch states it as one of the honors of Epaminondas, that he well performed the duty of the municipal office, which required him to keep clean the streets of Thebes. Ancient Rome drained those Pontine Marshes, which — now filled again — help to make a summer in Rome a peril, and to lay in untimely graves many of our fellow countrymen. Hippocrates taught the need and duty of pure air, pure water, and pure soil. Both the Greeks and Romans, in a way, studied and practiced public hygiene. Augustus limited the height of houses to seventy feet, and Trajan to sixty. Sink-pipes are to be seen at Pompeii, and the remains of the baths and the aqueducts of Rome are among the wonders of the ancient world. If the early monks and hermits and fanatics despised cleanliness, and rotted in rags, they did not the less disregard all the other teachings of Providence and common sense; and while Christianity laid down the common law of health in the precept, "Love thy neighbor as thyself," its great Author went about healing the sick, cleansing the lepers, and giving sight to the blind.

Nor were sanitary precautions wholly neglected in mediæval times. A sanitary statute of 1388 — probably the earliest enacted in England — imposed a fine of £20 for casting filth or refuse into rivers or ditches. In 1489, while Columbus was trying to persuade bishops and kings that the world was round, a law was enacted in England forbidding the slaughtering of cattle in cities and villages. In the reign of Henry the Sixth there were "Commissioners of Sewers."

In 1422 an English law restrained all men and women who had not graduated at Oxford or Cambridge from practicing medicine; and to the honor

of New York, by a law of 1872, she has placed men and women on the same level as to the right of practicing surgery and physic. When Queen Elizabeth, at a time when London had only 160,000 people, and, as she says, "the poor people inhabiting small rooms were heaped together, and in a sort smothered," could not devise any wiser relief, — she ordered that no house be built within three miles of the city. The records of Stratford on Avon show that the father of Shakespeare was fined, in 1552, for depositing filth in the public streets, and again in 1588 for not keeping his gutter clean.

Though such fragments as these suggest that they are but a small portion of the entire sanitary code, it is yet unquestionable that the health laws of those times fell below those of the present day, in the elements of science and benevolence, in much the same ratio that needless sickness and premature death were then more frequent and destructive than they are now. Macaulay says, "that it was in the seventeenth century that medicine became an experimental and progressive science and that the attention of speculative men was then for the first time directed to the important subject of sanitary police."

Now, before that date, and especially in ancient and mediæval times, it is a matter of familiar knowledge that plagues, leprosies, fevers, black deaths, destroyed such numbers and produced such terror and desolation as have been unknown to later times, unless in those half-civilized Asiatic and African regions where sanitary precautions are almost as much neglected now as then ; or in here and there a place in an enlightened country *conspicuous* for vice, filth, and the disregard of all the conditions of health. It is, I think, safe to say that London and Paris lost more lives needlessly, both by the plague and by the cholera, in ten weeks, than either of them have so lost during the last twenty years. Bordeaux, then one of the filthiest towns in Europe, lost 18,000 out of the 40,000 of its people in a few weeks. The plague remained longest in Naples, which was perhaps the worst ventilated and worst drained of the large cities of Europe.

There is nothing better settled in regard to life and health than that such diseases as cholera, yellow fever, small-pox, typhus and typhoid fever, can be in great measure kept away by good sanitary administration, the cost and loss of which is infinitesimal compared with what these diseases would cause. They have been, by such means, so far kept out of New York that for ten years they have caused less aggregate loss and cost, I presume, than either the toothache or the mumps. Cholera came five times to English ports in 1873, and twenty-eight died of it on one foreign ship in London, and yet such were the precautions that not a single Englishman took the disease. In the city of Bombay, with its population of 650,000, made up of all the races of Europe and Asia, and situated in a region where plagues and leprosies and choleras have through all historic time reaped their greatest harvests of death ; where, in 1820, 150,000 persons died from one of these scourges in a few weeks, and the average death-rate had always been alarmingly high ; in such a city, within a few years, good sanitary administration, introduced from England, has, by enforcing drainage, ventilation, adequate air-space, by having good water and wholesome food and general

cleanliness, accomplished results which are marvelous. The death-rate of Bombay in 1873 — only about an average year — was only slightly over 24 to a thousand of its people; and Dr. Harris says its death-rate in 1874 was 23.9 to the thousand, being a lower rate than that of Vienna, or Berlin, or New York, or Richmond, or Baltimore. Analogous results have been secured in Calcutta and Hong Kong.

Professor Lyon Playfair says the death-rate of London from 1660 to 1679 was not less than 80 out of every thousand each year. About the latter date, better sanitary precautions began to be applied in that city, and especially since 1848 they have been largely and continually improved. Much the same has been the sanitary history of Paris. The wonderful results are that these two largest are among the healthiest and the very cleanest of the great cities of the world. If New York, or Philadelphia, or Chicago, or St. Louis, or Cincinnati, or Baltimore was as cleanly and well paved as either Paris or London, the ratio of crime, poverty, death, and taxes would go down, their pride, population, and productive industry would go up, and republican institutions would be crowned with a new honor. The average death-rate of London for the past ten years has been only 24 to the thousand annually. In 1874, with its 3,400,700 people, the death-rate was only 22.04 to the thousand. The average death-rate of all England, for the ten years last past, has been 22.04 to her thousand, which is probably lower than in this country; so that good sanitary administration has brought down the death-rate of the two greatest cities in the world, and of the largest city of India, nearly to that of the general death-rate of two of the most healthy countries of the globe peopled by the most vigorous and enlightened of the races of men.

If we compare the general condition of different cities, in respect of cleanliness, good water, ventilation, drainage, and overcrowding, with their death-rates, whether they be cities of the same country or of different countries, we shall find a remarkable dependence of the rate upon the condition. So generally is this fact now observed and believed, that cities are humiliated or elated by the record of these dates; and when they are low, pride as well as a sense of duty, especially in Europe, where there is more complete sanitary registration, unite in promoting better sanitary administration.

Taking the records of 1873, and rejecting fractions, the death-rates per thousand of population per year in some of the principal European and American cities were as follows: London 22, and New York 29; Liverpool 25, and Philadelphia 19; Glasgow 28, and Richmond 33; Edinburgh 21, and Baltimore 24; Berlin 27, and Cincinnati 22; Birmingham 25, and Savannah 43; Dresden 34, and New Orleans 37; Munich 45, and Valparaiso (a very uncleanly city) 64. It will be observed that the average death-rate in American cities is higher than in England, though perhaps not higher than in German cities, where public health in cities has until very recently been neglected. Our city death-rate among children under one year of age is much higher than in English cities.

The high relative death-rates of Munich and Dresden have caused measures to be taken on a large scale for improving their drainage, water-supply,

and ventilation; and very soon we may be sure the rate will go down. The comparatively low rate of Liverpool has been secured by the most vigorous administration, which within a few years has produced results which every observing traveller has noticed.

Interesting results of sanitary administration in smaller cities and villages might be drawn indefinitely from English experience, and it is in that country that such administration has been carried forward with the most thoroughness. I give these examples from the report of the medical officer to Parliament, made in 1867, relating to villages of from 5,000 to 2,000 inhabitants. It comprises the health statistics of ten years before the sanitary reform, with those of the ten years following them.

In Cardiff, where typhoid fever and *diarrhœal* diseases had prevailed, the former subsided in the ratio of 17 to 10, and the latter in that of 17 to 4; while the aggregate death-rate of the place fell 35 per cent. In Salisbury the death-rate fell 20 per cent., and typhoid fever and diarrhœa subsided in the rates of 14 to 4. Consumption subsided in Salisbury 49 per cent., in Ely 47 per cent., in Rugby 43 per cent., in Bouberg 41 per cent., in Worthing 36 per cent., in Newcastle 32 per cent.

If considerable money was expended, it has been returned tenfold, not only in lengthened life, in exemption from sickness, and in capacity to work, but the sum of human happiness has been as much increased as the rolls of beggary, vice, and crime were diminished.

If anybody consoles himself with the thought that we need no such work in this country, let him read the first report (made in 1873) of the State Board of Health of Minnesota, — that fresh young paradise of health to which so many go to be cured. In that report we are told that in 1871, forty per cent. of all deaths in the State occurred among children not over one year of age; that more deaths are attributed to typhoid fever than to any other disease; that 3,000 persons are (constantly, as I understand) sick of that long, lingering, exhausting complaint; that the average age of those thus carried away is twenty-five years; that there is the least of such sickness in two larger cities where there is most cleanliness; and the chief cause of this disease the report declares to be "filth which accumulates about us, contaminating the air we breathe and the water we drink; that there is in most of the large towns a criminal want of attention to the construction of sewers and the removal of the contents of privies." Now, Minnesota is not, relatively, an unhealthy State, nor conspicuously in such sad sanitary condition. But what shall we say of a people, with such a record, which refuses to vote more than $250 per year to its Board of Health; or of Virginia, refusing to vote a dollar for its State Board of Health, while seeking immigrants from England in presence of a death-rate in Richmond a third higher than that of London in 1873, and higher than that of Bombay in 1874! And such facts as to the death-rate of young children under one year of age lose none of their painful interest, when we read in the English medical report of 1873, that in about one seventh part of England, the death-rate among children is only from eight to twelve per cent. of the entire deaths, and that in no district is that ratio higher than thirty per cent., that is, less than one half that of Minnesota.

I will add but two more illustrations, and these relate to the sanitary reforms in Edinburgh and Glasgow accomplished under special laws enacted in 1866, 1867, and 1871.

These statutes were far more comprehensive than any similar legislation in this country. They authorize the removal of tenants and buildings, the making of new streets and sewers and buildings, and the borrowing of money, and the mortgaging of taxes on a large scale. Such relief was indispensable in the older parts; the very buildings and ground plan of which, as in New York, had made a high death-rate inevitable. There had been filth, crowding, and disease, such that the account of them fills one with horror and disgust. I can only state the general results. Of money, $1,750,000 was expended in Edinburgh. Besides many altered, sixteen new streets were made, and 1,410 families were dispersed; but they were so aided that they got better accommodations elsewhere. There has been a general amelioration of the death-rate, and a great diminution of the typhus fever, which had long been the scourge of Edinburgh.

In Glasgow the work was on a larger scale, and the results have been most beneficent. About $7,000,000 of valuable property in the worst part of the city was purchased, and the buildings upon it (in number over 3,000) were rebuilt or remodeled. The 15,425 of the poor removed, got better accommodations. There has not been a case of fever or epidemic disease in the new buildings. The death-rate, which in 1869 was 34 to 1,000, had fallen in 1873 to only $29\frac{9}{10}$ to the 1,000. And what is more remarkable still, vice and crime have gone down as the health has gone up. In 1867 the whole number of crimes was 10,899, and by 1873 they had fallen to 7,869. The thefts in 1867 were 1,192, and in 1873 they had fallen to 264. Of larceny by prostitutes there were 578 instances in 1866, and only 256 in 1873; of thefts in brothels there were 405 in 1866, and in 1873 only 8. Thus, it appears that improved sanitary administration promotes law-abiding habits and purity of morals in much the same ratio that it improves the general health. And let us not forget that these reforms were not accomplished by arbitrary power, but by the free action of the citizens of Edinburgh and Glasgow taxing themselves, and working for the good of their cities. And in view of our *sanitary* conditions, we republicans may well pause in presence of such grand undertakings in the special interests of the poor, and for the common welfare of the whole people of a monarchy.

I am sure you have asked yourselves by what means this densely populated, monarchical old country — and some Americans speak of it as superannuated — that brings half of its bread from remote regions, has carried its death-rate and sickness below that prevailing in this fresh, open young country of freedom and abundance; by what means it is that Great Britain is able to produce, not merely her share of masterly intellects, but men of such physical qualities, that lofty mountain peaks — the most inaccessible wilds of unexplored continents — games, contests, and feats of endurance on land and water — not less than the death-rates, give evidence of their unsurpassed, if not their unequaled strength and vitality. I must answer in a few sentences.

It is more than twenty-five years since the people of England began to think and act in the direction of better sanitary administration, with an earnestness which a great proportion of our people have not yet attained. In 1848 health laws were passed, the scope of which would even now alarm the people in several of our States. The faith, intelligence, and disinterestedness of the medical profession, which generally takes the lead in such reforms, may not have been greater in England than it is here, but the labors and sacrifices of the medical profession have there had an audience and a support to encourage them not yet secured in this country. The English government has long acted upon the theory that true economy, not less than solemn duty, requires liberal appropriations of money and a large and firm use of authority, for the protection of the lives and the health of the people. The maxim of Franklin, that "public health is public wealth," is accepted and acted upon by the controlling majority in England. In nearly every part of Great Britain, attention to the official health reports is more general, and meetings for the discussion of sanitary questions are more frequent and largely attended than among us. The sanitary literature of that country — contained in reviews, official reports, maps, charts, tables, and separate volumes — is fivefold more extensive and instructive than that which this country has yet produced. Prime ministers, even, discuss sanitary reform before popular audiences, and declare it a part of their policy.

The sanitary laws not only extend to more subjects, but they are more stringent, and are enforced by a more discriminating public sentiment and a more vigorous administration than here. All *England*, for example, is divided into 15,000 sanitary districts, with a sanitary authority in each; and since 1872 there has not been a spot on the surface of England that has not been liable to feel, and if it needed, which has not felt, the direct exertion of such authority.

These 15,000 small districts are grouped into twelve larger divisions; and in each of these divisions there is an inspector, who reports directly to the "*Local Government Board*" in London; and over that board is one of the Secretaries of State, who is a member of the Cabinet. Connected with the board is a chief medical officer — now Dr. Simon, perhaps the greatest sanitarian in the world, — who has a similar relation to the Privy Council. The system is not a centralized or imperial one, but is such as to devolve the duty and responsibility as to each of the 15,000 districts, mainly upon its own local sanitary authority. But if in any district the death rate or the expenditure is too high, those responsible for it are liable to account for it to the Local Government Board. If local complaints are neglected, or nuisances are allowed, one of the twelve inspectors will soon appear in the district and make an investigation. All accounts of expenditures by each of these 15,000 authorities must be made up in a common form, and they are supervised by the "Local Government Board."

Each of these local boards, whether in city or country, has large authority upon most of the subjects I have enumerated as within the range of sanitary administration. As examples of what is being done, I may mention that in 1873 the National Vaccine Establishment furnished carefully se-

lected vaccine matter for use in 9,569 different places; that in 1874, in one of the twelve districts, 17,188 nuisances were removed; and that out of 206,008 nuisances complained of in all England in the same year, 204,000 were actually removed within that year.

To these reasons why the death-rate has so fallen in Great Britain ought to be added the facts, that the laws make it more difficult than it is here for an ignoramus, a knave, or a blockhead to get into or to remain in the medical profession; and generally it is more dangerous than it is here to bring deleterious food or drink, or adulterated medicines, upon the market.

And yet, despite all these precautions, and the wonderful reduction already made in the amount of needless disease and premature death, and the fact patent to every traveller that English cities are now much cleaner than American cities, Dr. Simon declares, in his report for 1875, that at least 125,000 of the 500,000 deaths which annually occur in England could be prevented "if existing knowledge of the chief causes of diseases were applied;" and further, that "*uncleanliness* must be received as the deadliest of the present removable causes of disease." And I may add that Dr. Elisha Harris, our highest sanitary authority on such a subject, — and to whom, with Dr. Stephen Smith, of New York, the country owes a measureless debt of gratitude, — declares, in his last annual report, that "artificial conditions greatly exceed all others in producing excessive death-rates, and the prevalence of disease in any portion of the population." Here, then, we have it on the highest medical authority of two great nations, that simple "cleanliness" — which the maxim says is "next to godliness" — will do more than all medicines to keep us healthy and long in this world; in short, the superior achievement of medical science is to secure good air, good food, good water, good drainage; in short, to keep clean.

As we leave this part of the subject, let us remember that a small reduction of a death-rate means a large reduction of disabling sickness — exemption from pain and anxiety in cases innumerable, and the value of which no money can measure,— and an improved physical tone and capacity for study, work, and happiness, equally incommensurable.

Dr. Playfair says if England could be relieved of 125,000 needless deaths annually, she would also be relieved of 4,200,000 cases of sickness; but he does not tell us of how many hundreds of millions of indigestions and headaches. Many striking illustrations of the truths herein set forth might be drawn from the sanitary administration of this country, but the limits of this paper forbid, and my selections might awaken jealousy. The beneficent results attained in the City of New York, however, are conspicuous. Beginning in 1866, when political doctors and ignorant and mercenary partisans were the health officers, the good work of sanitary reform, then placed and since continued in the hands of men of benevolence, science, and wisdom, has produced fruits in presence of which a great metropolis and a whole nation may well be proud and take courage. Contagions and epidemics have been disarmed and averted; noxious occupations and deadly nuisances without number, besides more than two hundred slaughter-houses, have been removed. Cellars, garrets, and tenement houses, more fatal than a

decree of Herod to infantile life, have, on a vast scale, been cleansed and ventilated; and the rate of mortality, the security, and the general comforts, especially of humble life, have been increased; the best registry of vital statistics in this country has been established, and last, but not least, an appreciative and inspiring public sentiment, which welcomes good sanitary administration as a public blessing, and has extended over the Union, has been there developed.

Boston is not much behind in the good work; and the State Board of Health of Massachusetts is shedding a steady light, in the presence of which we may fairly hope that New Englanders, at least some generations hence, will so far give up their universal habits of making two meals a day of pies, fries, and hot tartar biscuit; of roasting themselves beside iron stoves and having a chill in presence of a wholesome piece of cold meat or bread, that they will be allowed to live to a respectable old age in this world, and have a little time to learn the elements of cooking.

The sanitary wisdom of New Orleans has been a match for her contagious and pestilential enemies, and her health authorities in other ways have made for her an honorable record. Chicago has been doing a salutary work of hygienic reform; and, considering the scandals and official infidelities which tainted the atmosphere of Washington, it must be allowed that the Health Board in the District of Columbia has done well in keeping so many people alive and in good health.

I wish to call the attention of the too many small cities and large villages where the death-rate is near to or above thirty per one thousand each year, to that good sanitary administration continued for several years in Dayton, Ohio, which has brought down its death-rate, as shown in 1873, to only a fraction over sixteen to the thousand, and to Burlington, Vermont, where the same year it was but a fraction above twelve to the thousand.

It only remains to make a few suggestions as to the best method of organization for sanitary work: —

1. In sections where general intelligence and sanitary appreciation are low, I doubt not that the first organizations and effort will be made almost wholly by the members of the medical profession, and their action will need be confined mainly to inspecting, expostulating, inquiring, and reporting. But this stage soon leads to the next, when restraining power must be exercised, and property and persons must be made to bear the cost of removing the sources of disease and death, of which their condition or their neglects have been the cause.

2. The moment we attempt to exercise political power for sanitary purposes, that is, to use the government for compelling citizens to observe the general conditions of public health, and to pay the penalty of the infringement and the cost of redress, we must not seek our official force wholly from any one profession. No profession is strong enough to yield the power needed to stand up against the vast combination of the ignorant, the greedy, the vicious, and the lawless; nor has any one profession the learning or the wisdom for so difficult a work. Sanitary administration, which has to deal with property, constitutional rights, partisan interests,

institutions, buildings, and all the complications of business and commerce, as well as with the abstruse questions of chemical science, hygiene, and medicine, requires the most varied experience and capacity in its official force.

3. As no branch of administration has to do with so varied relations and interests, so in none is continuity of action and length of experience of more importance, and for these reasons, the terms of members of a board of health should be long, and they should not all expire at once. It is almost needless to say that where so much discretion must be allowed, where there are the greatest opportunities for corruption, where the want of wisdom and courage in the performance of duty may bring needless death and sickness into hundreds of families, and may send many other hundreds to the poor-house, there is as great necessity for pure character as for high capacity in the officers. On these points, as well as in reference to the necessary provisions for securing an efficient and economical sanitary administration, especially in a municipality, the example and the health laws, ordinances, and regulations of the City of New York will be found highly instructive.

And it is important to note that the highest courts of New York have decided that a health board may, under our constitutions, adopt and enforce ordinances, regulate trades and occupations, hold trials, and make and enforce orders which shall be a lien on real property, within the true scope of sanitary legislation, without being arrested by injunctions or delayed by demands for jury trials; but subject, doubtless, to having its action duly reviewed in the courts.

4. It seems to me that this coercive administration must be exercised in part by the nation, in part by the States, and in part by the municipalities, or within such divisions as may be made for sanitary purposes of the rural portion of the people.

Beginning with such divisions as the primary or local unit for administration, there should be a sanitary authority, with adequate power and a clear definition of duties, in each. It is plain that the causes which affect health, and the agencies which counteract disease, have neither their origin nor their sphere of influence confined to mere political divisions; and these facts must be more especially regarded in providing sanitary precautions for the rural districts. Until the public mind is more instructed, however, it will hardly be found practicable to provide those independent agencies of good sanitary administration, which I believe the near future is sure to demand.

At first we must make the best possible use of political divisions and existing officers, and at no time must we forget our legal principles or our constitutional structure.

5. It seems indispensable that there should be a State Board of Health in each State, which shall be a permanent, as it may be made a beneficent, part of the administration.

That board, in addition to the duty of making investigations and reports, and of supplying vigor and high intelligence to the whole system, should

have general supervision of vital (and perhaps criminal) statistics, should investigate all cases of extravagant expenditure, of excessive death-rate, and of alleged inefficiency or abuses in any local sanitary district; and to this State Board all local boards should be required to report.

6. But all this done, and still there would be a sphere of sanitary duty for the Federal government. Commerce between the States, and with foreign nations, the territories, the District of Columbia, and many reserved places, are subject to its jurisdiction. The army, the navy, the growing thousands in the civil service, in ships, in ports, in hospitals, in barracks, in the great offices in the cities, are under its control. As population shall grow dense, the impracticability of guarding against disease without this pervading force and varied territory of the Federal government being under wise sanitary provisions, in sympathy with State laws, will more and more appear. The army, the navy, and the marine hospital service, are now supplied with medical men in the service of the nation. The time may not be remote when the exigencies of foreign commerce will require more uniformity of quarantine regulations than the States now supply. It must be apparent that when the several States shall have active boards of health, there will be a vast amount of instructive sanitary information annually published, with no adequate means for its comparative arrangement, or for bringing it before the country at large. Cattle diseases, contagious epidemics, fevers, sweeping on from city to city, from county to county, from State to State, here following rivers, and there lakes and mountain ranges, will surely produce the conviction that a general cause of danger must be met by common arrangements for protection.

Already, in view of the fact that the most fearful contagions and epidemics, originating among degraded nations and on remote continents, threaten the whole commercial world, there is a growing conviction that the question of public health is not merely national but cosmopolitan; and international treaties, will, I believe, soon embrace the question of general health as one of the most important subjects.

The Federal government has already sanitary laws relating to many subjects, such as the ventilation and overcrowding of ships, hospitals, and asylums; the food, medicines, and housing of soldiers and sailors; and to the facilities to be afforded by Federal authorities for the execution of the quarantine and other health laws of the several States. It is not necessary, nor would it be wise, to increase the jurisdiction of the nation, at the expense of that of the States, and it would suffice if each within its sphere should wisely exercise that power which it possesses. And how can it be denied that the national jurisdiction over commerce, the authority which extends to every vessel, to every engine, to every passenger, to every package of merchandise on navigable waters; which surveys rivers, harbors, and the depths of the ocean; which searches out the school-houses, numbers the scholars, and, with the census, has already published sanitary charts of the whole Union, which on the sea-shore and on the inland hill-tops, gathers the signs of the wind, and of the rains, of heat and cold, and sends its bulletins through all the borders to instruct the fishermen and the farmers, — in presence of such facts,

I say, how can it be denied that it is the right and the duty of the general government to bring the diverse elements of its sanitary jurisdiction, as far as practicable, under one efficient Board which shall act in harmony with the Health Boards of the several States, and gather, arrange, print and send all over the Union those records of the origin, cause, and progress of disease and death, — those instructive and admonishing statistics of vitality and progress which measure the peril and the possibilities of commerce, which illustrate the power and the morality of a nation, which are the measure of our claims to the greatness to which we aspire and of our own fidelity to the religion which we profess. As a republic, proclaiming the common brotherhood of men; in presence of the evidence that the leading monarchies are now surpassing us in the protection given to life and health even among the poor and the humble; in view of the fact that commerce has woven all nations into such a network of dependence that a pestilence in Central Asia alarms the whole commercial world; can we longer as a nation fold our arms, and say that we have no duty and will have no part in the sublime Christian work — now elsewhere so high advanced — of building up better physical manhood, of removing to the utmost sorrow and sickness from homes, of increasing, as we may, length of days and days of comfort here on earth.

A SANITARY VIEW OF THE QUESTION, — "AM I MY BROTHER'S KEEPER?"

By LEWIS H. STEINER, M. D., *Frederick City, Md.*

A DISCOURSE DELIVERED BEFORE THE ASSOCIATION, AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

SOCIETY brings with it special duties and special obligations that are unknown to the hermit in his lonely cell or amid his self-sought solitude in the wilderness, and these duties and obligations increase and multiply in proportion as man's social relations widen and enlarge, being fewest in the isolated family, and most complex to the inhabitant of a crowded city, whose streets are resonant with the sounds of business and whose houses teem with a crowded population.

In the simple life of the *solitaire*, he has but to consider the hygiene of his own body, mind, and soul. The requisite conditions for the preservation of his bodily health are simply these: that food, clothing, light, heat, and oxygenized air should be present in sufficient quantity to meet the daily waste of life; to guard the body against injury arising from external natural agencies, and to secure that amount of light, heat, and oxygen which will insure a healthy development of the animal organism. His task is somewhat simple. If it be neglected, the result of the neglect is visited only on himself, in the shape of defective vitality, blunted senses, enfeebled constitution, and, ultimately, the embrace of the inexorable tyrant, Death. All admit that care for whatever will prevent such a result is a solemn duty that weighs heavily upon every human being, and that he should endeavor to preserve his faculties free from impairment, because under such circumstances he can best attempt the solution of the problem which has been specially assigned him. Self-preservation is said to be the first law of nature, and Satan, even, is represented in the Book of Job as saying, "Skin for skin, yea, all that a man hath will he give for his life."

But where the family relation begins to introduce other thoughts than those that belong to the low plane of self, and find their highest object only in the sphere of self-preservation, — when the necessities of protection against the rude elements of nature, and of controlling and subjugating its forces, compel man to seek the aid of his fellow-men and demonstrate the great advantages that spring from coöperation and associated labor, — then his duties rapidly increase. He can be no longer satisfied with what is only connected with his own comfort and convenience, or conclude that he has filled the full measure of his duty when he has but faithfully provided for the wants of his family. Gregarious by nature and habit, everything that affects the physical, mental, or spiritual character of his neigh-

bors will indirectly and insensibly make its impress upon him, so that he will be forced sooner or later to bear witness, willingly or unwillingly, to the fact that he is not a unit in the scheme of creation, but is so connected with the other members of his race that what is detrimental to them will be detrimental to him, and what will improve and elevate their condition will, in some mysterious way, exercise a like influence upon him. Intellectual surroundings will tend to sharpen his mental faculties, to increase his store of information, and to open up more comprehensive views of the domain of knowledge; while the prevalence of ignorance and indifference to intellectual culture will blunt his own native acuteness, contract his range of observation, and render him indifferent to that vigorous, active exercise of his mind which is indispensable to progress. A healthy moral atmosphere will react upon his own spiritual life and aid in the development of a higher and purer tone, while the vicinage of wickedness and vice will throw a deadening pall over high resolve and noble effort, depress his spiritual aspirations, and tend to drag him down to the lower plane upon which they live and flourish, and where they find the degrading food required by their morbid appetite.

Physical causes will in like manner make their impress upon bodily health. Where pure air and wholesome food, conjoined to other suitable hygienic conditions, exist, all those who dwell in the locality will be favorably affected, and disease will find subjects not very favorable for its development, while the prevalence of unsanitary conditions, such as the existence of wretchedness and filth, of vegetable and animal matter undergoing decomposition, of pestilential disease throwing off morbid particles into the atmosphere, will result in depression of vital forces, the development of morbid symptoms, and the inevitable appearance of premature death.

Babbage, in the fragment styled "The Ninth Bridgewater Treatise," sets forth most strikingly the permanent impressions that our words and actions make on the globe we inhabit. "No motion impressed," he says, "by a natural cause, or by a human agency, is ever obliterated. The ripples on the ocean's surface caused by a gentle breeze, or the still water which marks the more immediate track of a ponderous vessel gliding with scarcely expanded sails over its bosom, are equally indelible. The momentary waves raised by the passing breeze, apparently born but to die on the spot which saw their birth, leave behind them an endless progeny, which, reviving with diminished energy in other seas, visiting a thousand shores, reflected from each and perhaps again partially concentrated, will pursue their endless course till ocean itself be annihilated. . . . If the Almighty stamped on the brow of the earliest murderer the indelible and visible mark of his guilt, He has also established laws by which each succeeding criminal is not less irrevocably chained to the testimony of his crime; for every atom of his mortal frame, through whatever changes its severed particles may migrate, will still retain, adhering to it through every combination — some movement derived from that very muscular effort by which the crime itself was perpetrated."

The imagination can scarce follow the writer in his wonderful portrayal of

the permanent influence which our words and actions exercise, but the extract will assist us in comprehending the permanent effects for good or evil that arise from our intellectual, spiritual, and physical surroundings. We cannot avoid these effects; we must be bettered and improved by them, or we shall suffer from their deteriorating influences, and be compelled to do battle earnestly and vigorously against them. Hence we are obliged to interest ourselves in such surroundings, to go forth from our own homes, — however perfect they may be in all the conditions that insure healthy minds, souls, and bodies, — and to investigate the nature of those of our neighbors, so as to ameliorate and improve them, and by so doing to do unto others as we would they should do unto us, and destroy that which must inevitably injure ourselves and our own families.

The question addressed to the sanitarian, as he plods along in his efforts to eradicate the materials upon which disease feeds and flourishes, — addressed not only by the thoughtless trifler, but by the sensible householder, who with great self-composure is content with having made his own home neat and clean and pure, — is just the same as that employed by Cain, when God inquired concerning his brother Abel, "Am I my brother's keeper?" To this question in its sanitary aspect, attention is invited in the present paper. Am I in any way so interested in the preservation of my brother's health, that the duty rests upon me to see that the unwholesome sanitary conditions with which he is surrounded should be corrected and remedied, whether this be accomplished through the employment of argument or moral suasion, or by the stern authority of law? Upon the affirmative answer to this question, hinges that of the propriety and necessity of the creation of local boards of health with their sanitary codes, of State boards with supervisory powers over all subjects that concern the health of the citizens, and even of health associations composed of scientists and philanthropists, who believe that human life in any, even the lowest form, is something worth all the labor, care, and love that can be gathered up to make it bright, happy, and vigorous.

1. The subtle agencies, instrumental in the production of disease, are in many cases susceptible of being distributed in all directions from the person affected as from a prolific focus, and disease itself always contributes to the production of impurities which impair the invigorating influences of the conditions most favorable to health, insensibly taint the atmosphere and pollute the sources whence the water-supply is obtained. *Thus personal comfort and health*, and the comfort and health of my own household, make me interested in the sanitary condition of my brother. Of what avail are all my constant efforts to keep my house free from filth and impurity, my grounds neat and unpolluted with piles of decaying garbage and other substances, whose sight and smell may offend both the eye and nose, to keep a genial, healthy temperature in my rooms, and to promote such a circulation of air as may supply the benefits of good ventilation to my family, unless my neighbor is alike careful and cautious? If he is indifferent to the injurious effects of uncleanliness and filth in his house, to the offensive odors and repulsive appearance of kitchen and other refuse festering with decay

and corruption at his back-door, to the disgusting and nauseating effluvia that pour forth from the pen where his favorite swine are being carefully fattened for family use, to the establishment of such ventilation as may enable atmospheric currents to keep his rooms sweet and pure, — if, thanks to an unusually strong constitution, he is able to resist the depressing influence of all these, — do they not, however, so contribute to the pollution of the atmosphere that I and my household are deprived of our right to pure air for breathing purposes, of a right which is natural and indispensable to every human being. If he suffers the liquid flowing from the garbage and filth on his premises to saturate the soil so that the well, from which I am obliged to obtain the water that my family must use for domestic purposes, is the receptacle of this filthy extract, does he not, by this very criminal carelessness, contribute directly to the introduction of disease into my household, and make himself an enemy more insidious and deadly than if he were to declare war openly against me, and thus enable me to prepare for the defense of my fireside? More insidious and deadly, because the result of his inability to recognize and appreciate the necessity of cleanliness on his own premises, operates in such a concealed way against me and mine that I am powerless as regards defence. Thus the tenement-house with its overcrowded population, — all alike indifferent to or ignorant of the laws of health and the conditions necessary to preserve the latter, reeking with foul emanations that sicken the man who has never encountered them before, overflowing with human beings, who seem to have lost all ambition and desire for improvement, whose very countenances are indicative of the degradation and spiritual demoralization that reign within, — this, when located near me, becomes a source of infinite peril and danger to my family. However much I may preach the gospel of health, and practice its precepts in my own premises, the influence of such a pest-house will triumph over precept and example, bearing with it an injurious potency that can only be destroyed by the removal of the conditions that constitute it such an inconceivable nuisance. It has become a source of evil that will continue to affect my household, do what I can for the benefit of the latter, and leaves me but two lines of defence against its influences, — either to retreat to other and healthier surroundings, or to interest myself directly in the cleansing and improvement of the den where circumstances force my brother to dwell.

I am my brother's keeper, then, because the health of myself and household is directly involved in the sanitary conditions that prevail throughout his house and grounds, and is to a certain extent dependent upon his recognition or rejection of the laws of health. Thus personal considerations bid me consider his sanitary condition as one of prime importance to myself directly and personally, and the law of self-preservation intensifies the interest I should take in his welfare. It is singular how the brotherhood of man is demonstrated by this mysterious power, for good or ill, that one member of the race does exercise over the other. In the heyday of life, when the glow of health flushes the cheek, when the heart beats with happy impulse and joyous rapidity, when the spirits flow with a keen appreciation

of all that is bright and cheerful, when a roseate hue invests all nature and all the events of life with a bewitching charm, when love or friendship binds him to a special object or to the attractions of a chosen few, then that which is miserable or degrading — poverty, wretchedness, and suffering — produces no impression upon him. His life is in another sphere, and can have no sympathy whatever with objects that are commonplace and invested with sorrow. Health always finds it difficult to tolerate the thought of disease. The very idea is repugnant, and must be driven afar from the joyous soul, lest it bring gloom and unhappiness with it; and, similarly, the miserable condition of those who move on a lower plane of society has no more recognized appropriateness amid scenes of happiness and hours of enjoyment, than a hideous, ghastly skeleton, amid the glare, glitter, and revelry of a ball-room. At such a time the brother who is toiling amid filth and disease, struggling to eke out a miserable existence amid agencies and influences that degrade and brutalize, has no recognition. He can have no place on any branch of the family tree, not even a line in the complicated genealogical table which is a source of so much gratifying pride. He must have descended from some other source than him whom we are taught by orthodoxy to look upon as our common head, and possibly may furnish a species of presumptive proof, such as will satisfy the seekers for a new view on this subject, that the human race had not a single starting point, but that there were many instead of one Adam! And yet the fact, that the wretched, miserable being, who is so despised, or at least deemed beneath notice, may be the source whence shall flow sickness with its distaste for the society of family and friends, its disgust of all that is bright and joyous, its hours of racking pain and heart-rending anguish, its gloom and misery, — this fact shows how really and truly he is our brother, created with like powers and capacities with ourselves, and, if not a source of comfort and happiness, capable of creating a terrible amount of disease and suffering. This brother must be looked after, for although he may have no interest for us when health and happiness keep his image from our thoughts, yet he may be the innocent means of driving these from their apparently secure quarters, and of thus establishing his influence over us in this way if in none other. He has the power of dragging us down to the miserable plane on which he lives, if we will not bestir ourselves to elevate him to that which we more fortunately occupy; he will contribute the leaven of corruption and disease, if we will withhold that of health and happiness. If we will not help him to a healthful life, he will send the seeds of disease on every breeze that blows from his abode of infection towards our homes of health and happiness. If we will have no fellowship or fraternity with him in our prosperity and success, he will insure such by his power to destroy our felicity and mar our prosperity even when most attractive. Now if this be so, then are we compelled to undertake the oversight or guardianship of our brother by an argument that addresses itself most powerfully to us; we must see to his welfare, to the conditions that will best conduce to his health, because thereby we protect ourselves from the injury which he may do to our families, and we contribute to the development of such sani-

tary conditions in the neighborhood as will fit us best to contend against disease.

2. The interests of the whole community are involved in the sanitary condition of our brother, hence we must be his keeper on account of the duty we owe to the community itself. A single case of disease may not only be the focus from which injury shall come to our own family, but may be the cause of disease and death to countless others. The whole community is thus directly connected with the proper sanitary conditions of every house, even the humblest and most wretched, in its midst. Prevention here is infinitely better than cure, avoidance of danger more valuable than all the antidotes that science can furnish to meet the same when present. Each case of infectious disease is like an explosive missile thrown into a crowded community: it may destroy all within reach, and consequently no one is safe, and hence all the protection that can be furnished against its dangerous effects cannot be of equal efficacy with those which would prevent the missile being sent on its dangerous errand. The best protection is, to spike the gun.

The close relation of the health of the individual to that of the community has only been carefully studied in modern times. Indeed, the members of a community are so closely bound together that the term "organic" might be employed as descriptive of the relation existing between them. When any part of the animal body is affected by disease, a morbific influence pervades the whole which makes every limb, every muscle, yes, even the minutest part, to suffer from its presence. Similarly, there is no member of a community so unimportant but that his sickness will pervade, sensibly or insensibly, the whole, — and should this assume the form of grave disease, may more or less deleteriously affect the whole.

A case of typhus occurs where conditions ripe for its development exist, and straightway its influence is felt, on the right hand and on the left, until the outcast brother has become the most important, because the most dangerous, person in the neighborhood. A miserable prodigal returns to his father's house, after wallowing with the swine of foreign parts, brings with him the seeds of small-pox, which develop and infect all that come into contact with the household, and deformity, or, perhaps, death, is the penalty to friends for exposure to the contagion. And thus a host of diseases may be brought into a community by the exposure of one person to the conditions favoring their development, and these may then spread as "a circle in the water," until the morbific material has asserted its power over thousands, or until science has proven effective in staying its course. The young, the pure, the good, the best citizen, may thus become the victim of a neglect of the brother, — all are alike subject to the influence of disease when once developed, and all are interested in the prevention of such development and in the crushing out of the seeds of disease in the very nidus where they may have been planted.

The duty of looking after the brother's condition, and improving it as far as possible, is closely connected with our duty towards the community at large. A mysterious chain binds us all together. We cannot break this

and cowardly flee from the world and its cares. To mingle with the world and to do battle in it against wrong and misery, is a duty imposed on us all. The heroic soul will endeavor to perform this without fear and with a manly heart; he will rejoice that his courage is to be tried in such a contest. He must look after his brother, and lend him a helping hand to rise from the filth and degradation into which he may have fallen, whether from vice, crime, or criminal carelessness. He must aid, because by so doing he is laboring *pro bono publico.*

And what are all the wealth, refinement, luxury, knowledge, and science owned by a community, unless they are possessed by those whose bodily health may give the power of enjoying the same and using them for the good of others? Mere empty possessions, devoid of real significance, — brilliantly-adorned sepulchres full of rottenness and dead men's bones! What are pride of official station and a boasted line of ancestry, when disease cripples the energies and destroys the vital powers, but a sublime mockery? It is high health that is the normal prerequisite to success, whether of the individual or the nation. This nerves the arm, strengthens the spirit, toughens the muscle, and gives the power of doing deeds of daring, or of carrying on the agriculture, manufactures, and commerce that betoken prosperity. This makes arts of peace possible, and gives significance and efficiency to warlike efforts. This incarnates the thoughts and conceptions which the human brain produces, and gives them meaning and value for the race. This enables man to do the full measure of work that is meted out to him in the very problem of his individual existence, and to solve the same in its highest possible form.

But such health is the possible possession of man. True, the effects of past errors in ancestors may be transmitted through generations, and many may be thus deprived of this possession in consequence of the ignorance or vice of their forefathers; true, scrofula, consumption, and a nameless host of inherited vices of constitution are found all around us, bearing with them wretchedness, suffering, and misery; true, the birthright has been trifled with and impaired by those who should have transmitted it unsullied and untainted. But science enables us to modify, mollify, and mitigate many of these evils, and by the aid of its teachings we can recover from many of the effects of the impairment and regain the grand birthright, partially, if not wholly. Some of the defects of constitution may be removed, some inherited vices may be corrected, and the bills of mortality, instead of exhibiting a frightful increase, may be reduced to a rate that can be called normal. All this, to a certain extent, is in our power. The results attained by hard sanitary study in the past, bid us go in the same line, if we would achieve still greater success. There is no rest for the honest laborer in the cause of suffering humanity, because he finds in active work the greatest sphere of happiness and enduring usefulness; and in the amelioration of suffering, the cure of disease, and the establishment of conditions favorable to high health, he realizes how good a thing it is to labor for his brother-man.

3. And this brings me to the third reason why we should be our brother's keeper, because we thereby make him a more useful member of society,

raising him from the condition of a physical pest to that of a public blessing, and in this way actually increasing the resources of the State. Every citizen is either an element of weakness or strength in the body politic, either deprives the community of his own strength, energy, skill, and talents as well as that which may be needed to support him in his debility and sickness in the way of actual expenditure and personal attendance, or he adds directly to the general sum of wealth by his natural and acquired talents. Hence sickness and disease are direct enemies to prosperity, and must be treated as such by the statesman and political economist as well as by the sanitarian. The arguments resting upon personal danger and damage to the community, appeal to us because of the direct loss which the neglect of sanitary conditions on the part of the brother may inflict on the State, but the present argument demands our special attention because it involves a consideration of positive gain to be secured by causing him to conform to the laws of hygiene. A life plucked from the reeking atmosphere of malaria and filth, freed from those influences that depress and dull the spirits, and made to glow with health, is so much added to the wealth of the nation itself. And the obligation to rescue such a life rests upon society beyond the possibility of a release save in its fulfillment. No amount of knowledge or position in the social scale, no secular or religious calling, can free one from the obligation to do all that may lie in his power to aid in this rescue. *Men* are needed, however populous may be the nation, and work can always be found for them, somewhere within its borders, which will enhance its reputation and prosperity. They are needed to carry on its great systems of internal improvements, to manage, control, and operate in its great factories, to till the soil and win from mother-earth the bread-stuffs that are needed for the sustenance of a busy population, to conduct and operate its commercial transactions, to build houses for shelter and worship and for many other necessary, useful, and ornamental purposes, to develope and cultivate æsthetic tastes, to labor and toil in a thousand useful and ornamental ways which an advanced civilization requires for the satisfaction of its natural and acquired wants. There is room for workers everywhere, and none must be suffered to rust with disease, while there exists so wide-spread and urgent a demand.

The sanitarian, who brings one citizen into relations of activity and usefulness, otherwise a burden and a dead-weight upon society, contributes directly to the public wealth and deserves recognition as a public benefactor. The field is but little cultivated as yet, although modern science has taught us how to work it successfully, but the results are so encouraging that the laborers are daily increasing. What is wanted is a thorough knowledge of our obligation to see after the physical needs of our brother. Let this once be made known to the people, and that people will be disgraced that does not insist upon a careful attention to the same.

When war is declared against a civil power, whether within or without its borders, and threatens peril to national existence or honor, all hearts are gladdened by the uprising of the citizens in response to the demand for soldiers. The standards are borne aloft by men who hail the flag as something

worth living and dying for, and through the dangers of bivouac and camp, of skirmish and battle-field, the spirit of patriotism urges men onward to suffering and death. The heroic survivor is greeted by young and old, by men and women, with huzzas, welcomes, and crowns of victory. But here is another field, on which death or the subjugation of our fellow-men is not the object to be attained. A higher and nobler goal is that toward which we press; a purer and brighter ambition stimulates the soldiers in this army. To bring to active life that which is dying a daily death, to drag from wretchedness and misery those that may live lives of usefulness and happiness, to bring forth from wretched dens and miserable hovels our fellow-beings into purer, sweeter, and nobler conditions,— surely here is a grand duty, a sublime occupation for mankind. And when this must also contribute to personal and public protection, and to the wealth of the community of which these brothers form a constituent part, does not the duty of caring for their health and providing for their benefit become of so high and imperative a nature, that to be recognized as such it needs only to be presented in its naked and unadorned simplicity?

Certain corollaries flow forth from the discussion that I have here attempted, which may be considered as almost axiomatic after a recognition of the conclusions now reached. A brief consideration of these will close my present task.

1. The laws of health and the results of their violation should be freely communicated to the people, so that sanitarians may secure the aid of the people in their arduous labors. In order to insure the execution of a law in a republic, we must be supported by public sentiment in its favor, and this cannot be secured unless the people are fully informed as to its necessity and importance. Hence the necessity of popularizing the laws of hygiene, more especially those in reference to drainage, sewerage, ventilation, food, and clothing. Our systems of instruction frequently omit physiology and all that relates to human health from their curricula of study, and many a student graduates at our learned institutions with a smattering of the classics, a vocabulary of metaphysical terms, a meagre knowledge of mathematics and sundry physical sciences, and some superficial acquaintance with history and English literature, but utterly ignorant of the wonderful organism that connects him with the earth and of what may be necessary to keep the same in good working order. This is really an opprobrium, from which we should free the courses of our learned institutions.

The outlines of physiology and practical hygiene may be readily taught to the upper classes in our grammar schools, and a still more minute and thorough course should claim the scholar's attention as he advances in years and in scholastic attainments, so that when he leaves the schools, whether for practical or professional employment, he may be fitted to lend a helping hand in whatever concerns the health of the community. Then these subjects should be frequently discussed, by competent persons, as to their practical relations, in the village lyceum and before the city institute. Independent of their practical value, which should make them specially

attractive, there is also something very captivating about them when treated by an expert who has learned to appreciate their beauty as well as their utility.

Give the people an opportunity to know something about *themselves*, and they will begin to take active measures against defective drains, improper ventilation, and unwholesome food. They will rebel against improperly constructed houses, insist upon ample ventilation, and will not brook delay in the execution of sanitary reforms. Give them here in Baltimore more information on sanitary matters, and Jones's Falls and the Basin will cease to be subjects of wearisome chronic discussion, — will speedily be placed by competent scientific supervision in such conditions as will render them inoffensive and not open to complaint on the score of their insalubrity.

2. The public interest in hygiene should manifest itself in the encouragement of existing sanitary organizations and in the formation of new ones throughout the land. By such associations, a special stimulus is given to the branch of investigation to which they are devoted. Men always study most thoroughly that which is directly brought to their attention in their daily contact with their fellow-men, and strive to derive most practical benefit from it. Moreover, in associations of the character here contemplated, the subject itself should be presented practically, and be divested of the abstractions in which mere theoretical study more or less delights, because the membership should not be confined to mere scientific students or to those whose life is devoted to medicine, but should comprise engineers, architects, and builders, educators, and all interested in education, professional men and mechanics, fathers and mothers, in fact representatives of every class, occupation, and station in life. With such workers in the cause of public health, results may be fairly anticipated that will show diminished rates of mortality in our cities and the introduction of a high rate of health throughout the whole country. The owner of improperly constructed and badly ventilated tenement-houses will be adjudged guilty of a heinous crime unless he adopts suitable measures to remedy their defects; the vendor of diseased meats and unripe vegetables or fruits, a gross enemy to his race; the man who harbors on his premises nuisances which pollute and poison the pure air of heaven, a malefactor of the deepest dye; and every one who, by design or neglect, occasions the introduction of that which may affect the salubrity of a neighborhood, deserving of heavy punishment at law. Then the fact that every man is to a certain extent his brother's keeper, and hence bound to look after his condition, will be fully and thoroughly recognized by the people, who will be ready to respond to and warmly support all measures necessary to secure the highest order of health possible to a race designed to occupy, it is true, the earth but for a brief period of time, but requiring high health to perform the full measure of its duty.

3. Boards of health for towns, cities, and States (possibly for the nation also), should be established by proper authority and endowed with all necessary powers for the performance of their duties. It is of but little account to establish these unless they are founded upon an intelligent

recognition of their importance and necessity ; but where sanitary information has been widely disseminated, and the people recognize its value by forming organizations for its further dissemination and study, boards of health will constitute agencies for which they will clamor, in order that these may superintend and carry out all that is required for the preservation of the public health. Their necessity arises from the fact that the power of determining and pronouncing nuisances must be lodged in some body recognized by law and invested with sufficient authority to enforce its conclusions. When epidemics burst upon a community, there must be a department of the government, composed of experts sufficiently versed in their treatment, to limit their sphere of disaster and to protect the rest of the citizens. When legislation is to be executed in regard to health, it should be through the intelligent agency of those who have been trained in this branch of study.

Such boards will also become sources of advice as regards the erection of new buildings, the systems of drainage and sewerage to be adopted or altered in our cities and larger towns, the reclamation of submerged and marshy lands, the adulterations of articles of food offered for sale in our markets, the ventilation of factories, places of amusement, schools, and other buildings in which large numbers are to be collected, the avoidance of certain diseases which spring from vitiated air, and a host of other subjects of like importance.

They should be composed of experts, selected in utter disregard of their political views, and made to hold office until age, debility, or proven unfitness shall imperatively require their removal to give place to other more vigorous and better qualified successors. The selection of such boards on political grounds and for partisan reasons is one of the melancholy indications of the demoralization of our rulers, who, being chosen to office by a party, think it their bounden duty to fail to recognize in the members of the opposition any virtue, ability, or scientific knowledge that does not necessarily exist in a larger and more plentiful degree within its own ranks.

To health boards, selected on account of sanitary knowledge conjoined with executive ability, the public will learn to commit the sanitary interests of the country with confidence, and will be ready to lend every possible aid in the prompt execution of the plans they may propose and the orders they may issue. And when such is the case, then we shall have learned how great a duty it is to be "our brother's keeper."

American Public Health Association.

RECORD OF PROCEEDINGS AND SPECIAL PAPERS.

STATE BOARDS OF HEALTH.

AT the organization of the American Public Health Association, a standing Committee upon State and Local Sanitary Organization was formed; and its first report is now published. A draft of the required outline of an Act was submitted in January, 1875, at a meeting of the Executive Committee, and the following action was taken thereon: —

Resolved: That a copy of the report be forwarded to the executive and legislative authorities of all the States, together with a recommendation that health officers be appointed or Boards of Health be organized in all counties, towns, and cities throughout the several States, to coöperate with the said State Boards.

The following remarks by the committee correctly set forth the purpose of a draft of a project of law for the establishment of State Boards of Health: —

This outline of *An Act to establish a State Board of Health, and to assign certain duties to Local Boards of Health*, has been prepared after a careful examination of the field to be occupied by such a Board, and a thorough study of the peculiarities of the acts already passed by those States that are already supplied with such Boards. As the *enacting language* of almost every State differs, they have employed none, leaving that to be supplied in each State in accordance with its constitutional requirements or time-honored usage. In regard to the constitution of the Board, it may be desirable in some States, as New York, for instance, to include in the *personnel* of the Board such officers as the Comptroller and State Engineer, and in others, to reduce the number to four appointments by the Governor. These are, however, matters to be decided by each State for itself. They do not affect the other sections of the Act, which have to do with the definition of the duties of the Board.

PLAN OF AN ACT TO ESTABLISH STATE BOARDS OF HEALTH, AND TO ASSIGN CERTAIN DUTIES TO LOCAL BOARDS OF HEALTH.

Prepared by a Special Committee, and approved by the Executive Committee of the American Public Health Association.

SECTION 1. That the Governor, by and with the advice and consent of the Senate or Council, shall appoint six persons, three of whom shall always be physicians, who, with the Attorney-General of the State, shall constitute the State Board of Health. Of the six persons first appointed, two shall serve for two years, two for four years, and two for six years, from the first day of April next following their confirmation, and the Governor shall hereafter biennially appoint, by and with the advice and consent of the Senate, two members of said State Board of Health, to hold their offices for six years from the first day of April next following their confirmation. Any vacancy in said Board occurring during the recess of the Legislature shall be filled by the Governor until the next regular session of the same.

SEC. 2. That the State Board of Health shall meet at least once in every three months and as much oftener as they may deem proper, — their first meeting being held within two weeks after the first of April in each year, and four members shall always constitute a quorum for business. No member of the Board shall receive any compensation, but the

actual travelling and other expenses of the members while engaged in the duties of the Board, shall be allowed and paid out of the appropriation made for its support. They shall select, annually, one member of the Board as President, and shall appoint a suitable person, who shall be a physician, to be their permanent Secretary and executive officer, who shall hold his office so long as he shall faithfully discharge the duties thereof, but who may be removed for cause at any meeting of the Board, a majority of the members voting therefor.

SEC. 3. That the Secretary shall keep a record of the acts and proceedings of the Board, perform and superintend the work prescribed in this act, and such other duties as the Board may order under their general direction, and shall receive an annual salary of , which shall be paid him in the same manner as the salaries of other State officers are paid; and such necessary expenses as the Comptroller of the Treasury shall audit, on the presentation of an itemized account, with vouchers annexed and the certificate of the Board, shal be allowed him.

SEC. 4. That the said State Board of Health shall take cognizance of the interests of health and life among the people of this State; they shall make sanitary investigations, and inquire respecting the causes of disease, and especially of epidemics, the sources of mortality, and the effects of localities, employments, conditions, ingesta, habits, and other circumstances upon the public health, and they shall collect such information in respect of these matters as may be useful in the discharge of their duties, and contribute to the promotion of health and the security of life in the State; they shall cause to be made, by their Secretary or by a Committee of the Board, regular inspections at such times as they may deem best, and special inspections, whenever directed by the Governor or the Legislature, of all public hospitals, prisons, asylums, or other public institutions, in regard to the location, drainage, water-supply, disposal of excreta, heating and ventilation, and other circumstances in any way affecting the health of their inmates, and shall also suggest such remedies as they may consider suitable for the removal of all conditions detrimental to health in the said institutions in writing, to the officers thereof.

SEC. 5. That the said Board shall cause all proper sanitary information in its possession to be promptly forwarded to the local health authorities of any city, village, town, or county in the State, which may request the same, adding thereto such useful suggestions as the experience of said Board may supply. And it is also hereby made the duty of said local health authorities to supply the like information and suggestions to said State Board of Health, together with a copy of all their reports and other publications. And said Board of Health is authorized to require reports and information (at such times and of such facts, and generally of such nature and extent, relating to the safety of life and promotion of health as its by-laws or rules may provide), from all public dispensaries, hospitals, asylums, infirmaries, prisons, and schools, and from the managers, principals, and officers thereof; and from all other public institutions, their officers and managers, and from the proprietors, managers, lessees, and occupants of all places of public resort in the State; but such reports and information shall only be required concerning matters or particulars in respect of which it may in its opinion need information for the proper discharge of its duties. Said Board shall, when requested by public authorities, or when they deem it best, advise officers of the State, county, or local government in regard to sanitary drainage and the location, drainage, ventilation, and sanitary provisions of any public institution, building, or public place.

SEC. 6. That it shall be the duty of the State Board to give all information that may be reasonably requested, concerning any threatened danger to the public health, to the local health officers, and all other sanitary authorities in the State, who shall give the like information to said Board; and said Board and said officers and said sanitary authorities shall, so far as legal and practicable, coöperate together to prevent the spread of disease, and for the protection of life and the promotion of health, within the sphere of their respective duties.

SEC. 7. That said Board may, from time to time, engage suitable persons to render sanitary service and to make or supervise practical and scientific investigations, and examinations requiring expert skill, and to prepare plans and reports relative thereto. And it is hereby made the duty of all boards, officers, and agents having the control, charge, or

custody of any public structure, work, ground, or erection, or of any plan, description, outlines, drawings, or charts thereof, or relating thereto, made, kept, or controlled under any public authority, to permit and facilitate the examination and inspection, and the making of copies of the same by any officer or person by said Board authorized; and the members of said Board, and such other officer or person as may at any time be by said Board authorized, may, without fee or hindrance, enter, examine, and survey all such grounds, erections, vehicles, structures, apartments, buildings, and places.

SEC. 8. That it shall be the duty of the State Board of Health to have the general supervision of the State system of registration of births, marriages, and deaths. Said Board shall prepare the necessary methods and forms for obtaining and preserving such records, and to insure the faithful registration of the same in the several counties and in the central bureau of vital statistics at the capital of the State. The said Board of Health shall recommend such forms and amendments of law as shall be deemed to be necessary for the thorough organization and efficiency of the registration of vital statistics throughout the State. The Secretary of said Board of Health shall be the Superintendent of Registration of Vital Statistics. As supervised by the said Board, the clerical duties and safe-keeping of the Bureau of Vital Statistics thus created shall be provided for by the Comptroller of the State, who shall also provide and furnish such apartments and stationery as said Board shall require in the discharge of its duties.

SEC. 9. That the said Board, on or before the first day of January in each year, shall make a report in writing to the Governor, upon the vital statistics and the sanitary condition and prospects of the State, which report shall also set forth the action of said Board, and of its officers and agents, and the names thereof for the past year; and shall contain a full statement of their acts, investigations, and discoveries, with such suggestions for further legislative action or other precautions as they may deem proper for the better protection of life and health. This report shall also contain a detailed statement of the moneys expended by said Board, and the manner of their expenditure during the year for which it is made; but the total amount paid for the expenses of this Board, including the salary and expenses of the Secretary, shall not exceed   , which amount is hereby annually appropriated for this purpose, to be paid by the Treasurer, on the Comptroller's warrant, in such sums as the certificate of the Board, with proper vouchers annexed, may certify from time to time.

SEC. 10. That this act shall take effect from the date of its passage; and that all acts, or parts of acts inconsistent herewith, be, and the same are, hereby repealed.

ADDRESS OF WELCOME AT THE ANNUAL MEETING IN BALTIMORE.

BY JAMES A. STUART, M. D.,

Health Officer of the City, and Chairman of Committee of Arrangements.

THE pleasant task has been allotted to me of bidding you, our guests, a hearty welcome to the city of Baltimore. I welcome you, Gentlemen, in the name of the Mayor of the city, of the Board of Health (which I have the honor to represent), and in the name of my brethren of the medical profession as well as in the name of every reflecting man and woman in this community. And this is an occasion that justifies a welcome more than usually cordial. The great cause in which you are embarked touches the nearest interest of every grade and class of society, and awakens a sentiment of the deepest gratitude toward those who have engaged in this great work of the improvement of the Public Health. I can conceive of nothing more important, nothing more vital to the interests of every community throughout the length and breadth of this vast empire than that which has brought together this enlightened body of scientists and sanitarians. Our good city, during her two hundred years of childhood (for every Baltimorean will assure you she is yet in her infancy), has received many distinguished visitors; some bearing names perhaps more widely known than those borne by any here to-day. She has received and welcomed renowned statesmen, great diplomatists, illustrious soldiers. But is the gratitude of a country

more largely due to the statesman who devises a policy that will add dollars to the treasury or acres to her territory, than to the man whose patient studies have taught him how to lessen the mortality of her population? To the diplomatist who unravels to its obscurest end the clew of some dark intrigue, rather than to him who traces to its mysterious lair the secret cause of some foul pestilence? To the soldier who even for a noble cause, leads his thousands to the field of mutual slaughter, rather than to the heroes whose career has been a hand-to-hand struggle with *Death*, that their fellow men might live?

It has been often said, Mr. President, that the age of chivalry is past. I think it not so. I think there are men still among us who are the legitimate successors of the noblest knights of history or of tradition; who go forth, with no blare of trumpet or wave of banner, to fight with giants and monsters, as much more deadly as they are real, than the fabled ogres and dragons of fairy lore. It is not a mere flight of fancy to say that in the list of problems presented for your solution, there lie adventures to be achieved such as no knight of Arthur's Court ever undertook. The oldest poem in our literature [1] commemorates the deeds of a hero who, regardless of his own life, goes down to the regions of marsh and fen, from whose pools comes nightly forth a monster that destroys and devours men, which monster, after a fierce struggle, all unarmed, the hero slays, earning a gratitude that a nameless poet has made immortal.

But there are men whom no poet sings, whom no king loads with honors, who are even now engaged in the combat with the deadly invisible dragon of the marsh and drain, with the monsters of malaria and pestilence, and with those strange insidious forms of death lurking above us, beneath us, and around us.

"The most recent experiments tend to show that we have been vastly overrating the oxidizing and disinfecting properties of air, water, and earth. There can be no question of the fact, that we are drinking water and breathing air contaminated by sewage and sewage emanations, and the fact is admitted, that both air and water may be polluted, to a dangerous degree, without perceptible change in taste, color, or smell. We must not deceive ourselves because such poisons do not 'slay like the sword,' because long habit gives us a certain kind of immunity from evil results, and because, in our new and sparsely populated country, we have a soil not yet saturated with the filth of centuries."

It has been said that the two chief desires of a man in the eleventh century were, first, not to be killed, and secondly, to have a good tough leather coat. The progress of civilization has somewhat helped matters since then. In modern social conditions a man no longer expects, as a general thing, to be stabbed at the next turning of a corner, or from behind the first hedge. Under improved sanitary conditions we no longer fear those terrible pestilences, such as five hundred years ago swept away half the population of Christendom. But the civilization that has destroyed old enemies has brought in new ones, which it is our task to deal with. Altered conditions of living, the accumulation of people in large cities, the development of arts and manufactures, even the extension of learning, have all introduced new causes of disease and death. Arts which add to the luxury of living, or provide us with necessary comforts, often entail upon those who practice them, terrible and deadly sufferings. But this altered condition makes it possible to combat these on conditions unknown before. The student of physical laws is no longer a cloistered recluse, groping his way alone into the secrets of nature; he is furnished with magic weapons from the armory of science; he has at his command all the learning of the earth; by reaching the hand of fellowship to a fellow student, he lays hold upon a chain which stretches round the world. Our modern civilization has made all students of science, members of one family; has made possible that concert of activity, that *association*, which enables you, gentlemen, scattered over half a continent, to meet here to-day for united and systematic deliberation for the common good. This is no doubtful assumption. Physiology, hygiene, questions of quarantine and sanitary regulation, are rapidly coming to the front in the interest of the thoughtful, even among non-professional men. It is everywhere in process of recognition that *health*, the first of blessings, is a subject of law. Vital statistics, both for economic and beneficiary purposes, are being studied with a zeal and research before unknown. The most recondite resources of the highest mathematics are taxed to supply formulæ for life averages and contingencies. And I greatly mistake the symptoms and

[1] Epic of Beowulf.

presages of the times, if henceforth and for several generations to come, questions appertaining to sociology do not outrank those of politics not only in select but in popular interest.

Again in the name of the city, whose spokesman in this respect I will presume to be, I bid the association a hearty welcome to Baltimore.

LETTER FROM THE ARCHBISHOP OF BALTIMORE.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER, 1875.

FROSTBURG, ALLEGHANY COUNTY, MARYLAND, *September* 29, 1875.

My Dear Doctor, — My physician has strictly commanded me to do as little work as possible, a prescription which my official duties render it almost impossible for me to take; still I feel myself bound to obey him as regards everything extra-official, and so you must "hold me excused." I would be very willing to say a few words, under such favorable auspices, upon some points which have come under my own observation, connected with the important object you have in view, in the hope that I might do some little good in helping the good work along. Although the benefits you seem to obtain, are of importance to the whole community, yet they regard in a special manner the *poor and laboring classes*, who comprise the great majority of my flock, and in whose welfare I am naturally most deeply interested.

In recalling to my recollection the old ship-fever days, when we labored among the poor and suffering, you remind me how much progress has been made in these matters since that time; and chiefly through the labors of your Public Health Associations. Our forefathers lived more out of doors than we do; and had large open fire-places and chimneys in their houses, with plenty of good fresh air flying about, so that there was not so much need of their studying these things. But it is wonderful how little attention they paid to the simplest principles of ventilation even in places where it was most needed. I was chaplain, as you will remember, to the New York Quarantine Hospitals, during the pestilence of 1846–47, and if there be any place in this world that needs thorough ventilation, it is a ship-fever ward, and yet scarcely any attention seemed to be paid to it. During the very cold weather the windows could only be opened very slightly at the top, and the only thing that gave any of us who entered the wards a chance for our lives, was the old fashioned fire-places, and although they are the best of all ventilators, I need not say to you, that they had not been placed there with any reference to their ventilating qualities.

I never think of those terrible days, as they were called, without recalling to mind the generous self-devotion of the many young physicians who volunteered to take care of the sick. No sooner did one fall before the pestilence, than another was found ready to take his place, until nearly forty, I think, sacrificed their lives to the call not so much of duty, as of charity. But although they understand these matters better in our days, and everybody recognizes the necessity of pure air, and of pure water, and proper drainage to health, at least in theory, it seems to me that in practice we are not much better off than in the old times, at any rate in our own country. When I first went abroad, in 1841, I remember recording in my journal of Paris that it was a ".dirty" city. Outside of the great thoroughfares, the gutters were still in the middle of the streets, and the usages which made Edinburgh in the days of Dr. Johnson's Bozzy "somewhat dangerous and highly odoriferous" were still in vogue. Now it is the cleanest and best lighted city in the world, whilst some f our American cities are still as dirty as the towns in China. We all know what drainage has done for London and the river Thames, for the river needed drainage as much as the city. In 1841, by putting into it a quantity of "dead oil," so as to cause the more solid substances in the old river to coalesce, you might literally have set it on fire. Its waters, so called by courtesy, may have been good for the manufacture of beer and brown stout, but then may have been a poor article to make tea with. A proper system of drainage has made towns in England and Scotland, which were decimated almost every year by typhus, thoroughly healthy. There are few things, in which cause and effect are more closely united than bad drainage and typhus.

With us, the great difficulty is, in having the sound principles which science has made known to us upon the subjects, carried out into practice. This comes, as we all know, from our political system, which however beautiful in theory, is never more unfortunate in practice than when applied to municipal matters. The plague-spot on our city of New York is the system of tenement-houses, covering often every inch of the lot upon which they are built, badly lighted, badly ventilated, and badly arranged in every respect except for the landlord's purse. No one who has not seen them, would believe that such places would be allowed to exist in a city calling itself Christian and civilized. I have attended cases of malignant fever in rooms which had no window to them, and where the only light and air which reached them came through the door, and out of which as a necessary consequence the patient had soon to go out a corpse, and although some improvement has been made since those times, yet I am afraid that in the main, things have been allowed to continue much as they were, chiefly because it would be "inconvenient" to interfere with gains of the owners of these pest-houses. But there is no need of my writing about these things to you, who know all about them, much better than I do. In acknowledging the receipt of your letter they have come into my mind, and I have allowed them to run off the end of my pen, as they would have run off the end of my tongue if I had been talking about them. I most earnestly wish your Association every success, and trust that the able and public-spirited gentlemen connected with it, will never rest until they have instilled sound principles upon the subject into the whole body politic. I know that it will require something like trepanning to convince our city corporations, but even they may at length be convinced that it is a bad policy to allow the avarice of a few individuals to stand in the way of the health and comfort of a whole city, and that one of the ways to avert the evils which threaten society, from what are sometimes called the dangerous classes, is to give them a fair chance to breathe, and protect them by the rigorous exertion of authority against bad drink, bad air, and the covetousness of tenement-house owners. In our good city of Baltimore, let me mention to you, that we have a little local grievance of our own, called "the basin," which you may help us, I will not say in calling attention to, because it does that most effectually itself, but perhaps in curing. If you can convince our city Fathers that a large cess-pool in the midst of a city is not calculated to add either to its health or agreeableness as a place of residence, and thus cause them to have it purified or filled up, you will not only do a grand stroke of business strictly in the line of your Association, and which some future orator may compare to one of the labors of Hercules, but entitle yourselves to the lasting gratitude of all good Baltimoreans.

(*Signed.*) J. ROOSEVELT BAYLEY, *Archbishop of Baltimore.*

To Elisha Harris, M. D., *Secretary.*

ABSTRACT OF MINUTES OF THE MEETINGS OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, FROM APRIL 18, 1872, TO NOVEMBER 12, 1875.

PRELIMINARY MEETING IN NEW YORK, APRIL 18, 1872.

At a meeting of gentlemen interested in the study of sanitary science, held at the New York Hotel, Friday evening, April 18, 1872, the following gentlemen were present: Drs. Stephen Smith, Elisha Harris, E. H. Janes, Heber Smith, Moreau Morris, and Carl Pfeiffer, Esq., of New York; Dr. Francis Bacon of New Haven; Dr. Christopher Cox of Washington, D. C.; Dr. John H. Rauch of Chicago. Dr. E. Harris, chairman, and Dr. Janes, temporary secretary.

The chairman stated the objects of the meeting, and briefly reviewed the methods of studying and repressing the causes of epidemics and the preventable kinds of diseases by the help of hygiene and the application of physical knowledge generally to public health questions. Dr. Stephen Smith spoke of the necessity for a national organization limited in membership to the best of sanitary workers, the increased interest generally felt in sanitary matters, and of the small amount of real knowledge obtained for want of combined action. Dr. Rauch said that he could testify to the growing interest manifested in sanitary matters in the West as shown by the frequent applications for information and for health reports, for which he had never known so great a desire as during the last few months, and he thought it now most important to effect an organization and elect permanent officers and members. Dr. Cox suggested that committees be at once appointed to perfect a plan of organization and to arrange place and time of meeting. Mr. Pfeiffer and Dr. Bacon each made suggestions in regard to the memberships in the proposed association.

It was then unanimously voted that the persons present, together with those in attendance at the morning meeting, and others whose names are given, declare themselves a temporary committee for the purpose of creating a permanent Association for promoting public health interests. It was also voted that a committee on permanent organization be elected, and that this committee consist of ten members.

The following gentlemen were then elected: Dr. Stephen Smith, Chairman, Drs. George H. Derby, Mass., Francis Bacon, Conn., Elisha Harris, N. Y., John H. Rauch, Ill., C. C. Cox, D. C., Wm. Clendenin, Ohio, Wm. Marsden, Can., C. B. White, La., F. Peyre Porcher, S. C.

It was voted that the committee be enlarged, whereupon the following gentlemen were added: Drs. W. Parker, Mo., Thomas Stewardson, Pa., and Henry Gibbons, Cal. It was also voted that the Surgeon General be requested to designate some member of the medical staff of the army to serve on this committee, and that the same courtesy be extended to the medical staff of the navy. The following named gentlemen were then added: Dr. J. M. Woodworth, Chief of U. S. Marine Hospital Service, Dr. M. Morris, N. Y., Dr. James Reeves, W. Va., Dr. Jerome Cochrane, Ala., and Dr. E. H. Janes, N. Y.

MEETING AT LONG BRANCH, SEPTEMBER 12, 1872.

Pursuant to notice, a meeting of gentlemen interested in the formation of a National Public Health Association was held at the Ocean Hotel, Long Branch, N. J., September 12, 1872. The meeting organized at 1.30 P. M., Dr. Elisha Harris of New York being chairman. There were present: Drs. C. C. Cox of Washington, D. C., John M. Woodworth, Chief of Marine Hospital Service, Henry Hartshorne, Pa., John H. Rauch, Ill., William Clendenin, O., C. B. White, La., C. F. Chandler, Elisha Harris, Stephen Smith, Moreau Morris, C. P. Russell, and E. H. Janes of N. Y. Subsequently Dr. Francis Bacon of Conn., and Mr. Carl Pfeiffer of N. Y., were present.

The minutes of the preliminary meeting held April 18, were read and approved. Drs. Hartshorne, Russell, and Chandler being present by invitation, were declared members of the Association. The chairman stated the object of the meeting to be the completion of the organization already commenced, and called for the plan proposed by the committee. The proposed plan of organization was then presented, which was revised and adopted as the Constitution of the American Public Health Association. Dr. Cox presented the draft of a bill, which he proposed should be presented to Congress for the establishment of a sanitary bureau as a part of the Interior Department of the government.

Evening Session. It was voted, before adopting the Constitution as a whole, to nominate and elect members, and the following gentlemen were accordingly elected: —

Fred. Law Olmsted. New York.
J. A. Comingor, M. D., Pres. of Board of Health, Indianapolis, Ind.
H. A. Johnson, M. D., of the Board of Health, Chicago, Ill.
John S. Newberry, M. D., Professor in the School of Mines, Columbia College, New York.
S. Oakley Vanderpoel, M. D., Health Officer, Port of New York
Thomas L. Neal, M. D., Health Officer, Dayton, Ohio.
Thomas M. Logan, M. D., Secretary State Board of Health, Sacramento, Cal.
Charles N. Ellinwood, M. D., U. S. Marine Hospital Corps, San Francisco, Cal.
Henry Bronson, M. D., New Haven, Conn.
Charles N. Hewit, M. D., Secretary of Board of Health, Davenport, Minn.
J. S. Billings, M. D., U. S. Army.
Isaac Ray, M. D., West Philadelphia, Pa.
Daniel G. Gilman, LL. D., President California University, San Francisco, Cal.
B. F. Ketcham, M. D., Pres. Board of Health, Mobile, Ala.
G. A. Moses, M. D., Board of Health, Mobile, Ala.
George W. Peate, M. D., Health Officer, Galveston, Texas.
C. R. Agnew, M. D., New York.
Joseph Parrish, M. D., Media, Pa.
Augustus C. Hamlin, M. D., Health Officer, Bangor, Me.
Ephraim Cutter, M. D., Woburn, Mass.
E. J. Marsh, M. D., Health Physician, Paterson, N. J.
David Little, M. D., Health Officer, Rochester, N. Y.
Ernst Krackowizer, M. D., New York.
John McArthur, M. D., Philadelphia, Pa.
James Johnson, M. D., Health Officer, Milwaukee, Wis.
Josiah C. Nott, M. D., New York.
Jacob S. Mosher, M. D., Deputy Health Officer of the Port of New York.
H. F. Askew, M. D., Wilmington, Del.
Ezra M. Hunt, M. D., Metuchen, N. J.
W. L. Barret, M. D., St. Louis, Mo.
J. T. Hodgin, M. D., St. Louis, Mo.
John Bryson, M. D., St. Louis, Mo.
J. R. Cabell, M. D., Charlottesville, Va.
George M. Andrews, M. D., Detroit, Mich.
Homer O. Hitchcock, M. D., Kalamazoo, Mich.
William Marsden, M. D., Quebec, Can.
Philip Carpenter, Ph. D., Montreal, Can.
Asa Horr, M. D., Dubuque, Iowa.
Prof. Oran W. Morris, New York.
Prof. Joseph Henry, Smithsonian Institution, Washington, D. C.
Prof. Julius E. Hilgard, U. S. Coast Survey, Washington, D. C.
Prof. Wolcott Gibbs, Harvard College, Mass.
B. F. Craig, M. D., U. S. Army.
Joseph J. Woodward, M. D., Surg. U. S. Army.
Morrill Wyman, M. D., Cambridge, Mass.
Henry W. Dean, M. D., Rochester, N. Y.
Hon. Andrew D. White, Pres. Cornell University.
Prof. James Law, Cornell University.
Prof. A. F. Liautard, N. Y. Veterinary College.
Gen. Albert F. Meyer, M. D., Chief of the Signal Service, War Department.
E. R. Squibb, M. D., Brooklyn, N. Y.
Dorman B. Eaton, Esq., New York.
Edward Jarvis, M. D., Dorchester, Mass.
Francis H. Brown, M. D., Boston, Mass.
Prof. E. L. Youmans, New York.
Charles Lewin, M. D., Baltimore, Md.
Lewis H. Steiner, M. D., Frederick City, Md.
William C. Wey, M. D., Elmira, N. Y.
Joseph M. Toner, M. D., Washington, D. C.
Robert D. Murray, M. D., U. S. Marine Hospital Key West.
Richard Arnold, M. D., Savannah, Ga.
Peter Pineo, M. D., Marine Hospital Corps, Hyannis, Mass.
A. W. Smythe, M. D., New Orleans, La.
A. N. Bell, M. D., Commissioner of Quarantine, Brooklyn, N. Y.
S. C. Russell, M. D., Secretary of Board of Health, New Orleans, La.
Prof. G. W. Hough, Dudley Observatory, Albany, N. Y.
A. W. Perry, M. D., New Orleans, La.
George Derby, M. D., Secretary Mass. State Board of Health, Boston, Mass.
William E. Worthen, C. E., New York.

On motion, the consideration of the plan of organization was resumed, and it was further amended.

The Association then proceeded to the election of its first officers, with the following result: —

President — Stephen Smith, M. D., New York.
1st Vice-President — Edwin M. Snow, M. D., Rhode Island.
2d Vice-President — C. B. White, M. D., Louisiana.
Treasurer — John H. Rauch, M. D., Illinois.
Secretary — Elisha Harris, M. D., New York.

EXECUTIVE COMMITTEE.

Elected Members.

Francis Bacon, M. D., Conn.
Wm. Clendenin, M. D., Ohio.
Christopher C. Cox, M. D., D. C.
Henry Hartshorne, M. D., Pa.
Moreau Morris, M. D., N. Y.
John M. Woodworth, M. D., D. C.

It was then voted that the Executive Committee be authorized to publish the Constitution when adopted, together with a list of the actual members, and that a copy of the same

be presented to each member elect with the notice of his election. It was also voted that the time and place of the first annual meeting be left to the decision of the Executive Committee. The Secretary was instructed to correspond with hygienists abroad for information concerning the prospective movements of cholera.

The plan of organization was then voted complete, and adopted as the Constitution of the American Public Health Association.

CONSTITUTION OF THE ASSOCIATION.

TITLE. — 1. This Association shall be called "The American Public Health Association."

OBJECT. — 2. The objects of this Association shall be the advancement of sanitary science and the promotion of organizations and measures for the practical application of public hygiene.

MEMBERS. — 3. The members shall be selected with special reference to their acknowledged interest in, or devotion to, sanitary studies and allied sciences, and to the practical applications of the same. They shall be elected as follows : —

Each candidate for membership shall first be proposed to the Executive Committee in writing (which may be done at any time), with a statement of the business or profession, and special qualifications of the person so proposed; on recommendation of a majority of the Committee, and on receiving a vote of two thirds of the members present at a regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership shall be five dollars.

OFFICERS. — 4. The officers shall be a President, a First and Second Vice-President, a Secretary, and a Treasurer.

The President shall be elected for a term of two years; the Secretary shall be elected for a term of three years; and all the other officers shall be elected annually.

PRESIDING OFFICER. — 5. The President, or, in his absence, one of the Vice-Presidents, or, in their absence, a chairman *pro tempore*, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all committees authorized by the Association, unless otherwise specially ordered.

SECRETARY. — 6. The Secretary shall have charge of the correspondence and records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association; and shall give notice to the several officers, and to the executive and other committees, of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER. — 7. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds, he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments; and at each annual meeting, render the same to the Association, when a committee shall be appointed to audit his accounts. If from the annual report of the Treasurer there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

COMMITTEES. — 8. There shall be a standing committee, to be known as "the Executive Committee," which shall consist of the President, the First Vice-President, Secretary, and Treasurer, and six members annually elected by ballot.

All committees, and all members preparing scientific reports or papers to be laid before the Association, at its annual meetings, must give, in writing, the title and outline of such reports or papers to the Executive Committee, at least six weeks preceding the date of such meeting, to secure their announcement in the order of business.

EXECUTIVE COMMITTEE. — 9. It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association; to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of

current expenses; to consider all applications for membership, and, at the regular meetings, report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the Association, and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association; such notice shall contain the order of business to be followed at said meeting, and briefly, the subjects to be presented, and the special points of discussion.

MEETINGS. — 10. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called, at any time or place, by concurrence of two thirds of the Executive Committee. There shall be no election of officers, or members, or change of By-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular to all the members, together with the order of business.

QUORUM. — 11. At the annual meeting, twenty-five members shall constitute a quorum for the election of officers, a change of the Constitution, the election of members, and the appropriation of moneys. Ten shall constitute a quorum at any session devoted to the reading of reports and papers, or discussions.

ORDER OF BUSINESS. — 12. The order of business at all meetings of the Association shall be fixed by the Executive Committee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four fifths present.

ALTERATION OF CONSTITUTION. — 12. No alteration in the Constitution of the Association shall be made except at an annual meeting, and unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two thirds of the members present.

The next day (September 20) was devoted to the discussion of questions proposed by members, and after a free interchange of opinions, the following subjects were referred to special committees for investigation, and report at subsequent meetings: —

COMMITTEES. — *On Coöperative Sanitary Legislation between the National and State Governments:* Chairman, DORMAN B. EATON, Esq., New York.

On the Comparative Mortality at Different Seasons of the Year in the Various Sections of the United States: Chairman, PROF. HENRY HARTSHORNE, M. D., Philadelphia, Pa.

On Healthy Dwellings for the Poor, and the Sanitary Reconstruction of Unhealthful Houses: Chairman, STEPHEN SMITH, M. D., New York.

On Local and Domestic Causes of Tubercular Phthisis, with Reference to Preventive Measures: Chairman, PROF. HOSMER A. JOHNSON, M. D., Chicago, Ill.

On the Codification and Digest of Laws relating to the Public Health in the several States: Chairman, PROF. JOHN ORDRONAUX, M. D., New York.

On the Propagation of Diseases of Animals to Man: Chairman, WILLIAM CLENDENIN, M. D., Cincinnati, Ohio.

On Sanitary Drainage of Towns and Cities: Chairman, J. H. RAUCH, M. D., Chicago, Ill.

On Water-Supplies for Cities and Villages: Chairman, PROF. C. F. CHANDLER, New York.

On the Practical Lessons of the Recent Prevalence of Small-pox, with Reference to its Prevention in the Future: Chairman, E. H. JANES, M. D., New York.

On the Progress and Prevention of Asiatic Cholera: Chairman, E. HARRIS, M. D., New York.

On Quarantine and the Official Method of Sanitary Control of Contagious and Infectious Diseases: Chairman, PROF. HENRY HARTSHORNE, M. D., Philadelphia, Pa.

On the Sanitary and Medical Management of the Mercantile Marine, and the Care of the Sick Seamen, with Reference to the Interests of the Public Health: Chairman, J. M. WOODWORTH, M. D., Washington, D. C.

On Hospitalism and the Relations of Hospitals to the Public Health: Chairman, STEPHEN SMITH, M. D., New York.

On Restrictions upon Prostitution and Syphilis: Chairman, W. S. BARKER, M. D., St. Louis, Mo.

On a National Sanitary Bureau: Chairman, CHRISTOPHER C. COX, M. D., Washington, D. C.

On a Uniform System of Registration of Diseases and the Causes of Death: Chairman, CHARLES P. RUSSELL, M. D., New York.

On Public Health Reports, and the Means of Promoting a Practical Knowledge and Application of Sanitary Science among the People: Chairman, C. B. WHITE, M. D., New Orleans, La.

On Heated Terms, and the Methods of Determining the Movements of Heated Areas: Chairman, LORIN BLODGETT, Esq., Philadelphia, Pa.

On the Facts and Records of Meteorology and Climatology that may Promote Sanitary Knowledge: Chairman, G. W. HOUGH, M. D., Albany, N. Y.

On the Influence of the Production and Use of Native Wines upon the Vice of Intemperance, and upon the Public Health: Chairman, CHARLES N. ELLINWOOD, M. D., San Francisco, Cal.

On Areas of Sanitary Administration, and the Practical Adaptation of General Laws and Local Ordinances Relating to the Public Health: Chairman, E. HARRIS, M. D., of New York.

On the Practical Applications of Chemistry in Public Hygiene: Chairman, C. F. CHANDLER, Professor of Chemistry, New York.

On the Influence of Existing Social Systems on Health and Longevity: Chairman, FRANCIS BACON, M. D., New Haven, Conn.

On Sanitary Principles and their Requirements, applied to Public Edifices and Private Residences: Chairman, CARL PFEIFFER, Architect, New York.

On the Sanitary Value and Uses of Shade Trees, Parks, and Forests: Chairman, FRED. LAW OLMSTED, Landscape Architect, New York.

On the Sanitary Preparation and Improvement of Sites of Cities and Villages: Chairman, PROF. JOHN S. NEWBERRY, M. D., Ohio.

After the consideration of various questions relating to the business of the Association, the following resolutions were adopted: —

Resolved, That the Executive Committee have power to make any needed or useful rearrangement of individual members in the committees, after communicating with the members concerned.

Resolved, That the Committee on Meteorology be instructed to avail themselves of the aid and suggestions of General Meyer, Chief of the Signal Corps, U. S. Army, in regard to the scheme of meteorological observations, that may best be made available in studying the phenomena of epidemics.

Resolved, That the Executive Committee be directed to prepare a brief sketch of the history and purposes of this Association, together with an abstract of the minutes of its preliminary meetings, and publish the same with the Constitution.

Resolved, That when the Association adjourns, it will adjourn to meet in the City of Washington during the last week in February, at the call of the Executive Committee.

ANNUAL MEETING AT CINCINNATI, OHIO, MAY 1–3, 1873.

A meeting of the Association convened at Cincinnati, Ohio, May 1, 1873, in the hall of the Cincinnati College, Dr. Stephen Smith, New York, President, in the chair.

The following gentlemen were present: Drs. Edward Jarvis, Dorchester, Mass., Edwin M. Snow, Providence, R. I., A. N. Bell, Brooklyn, N. Y., Stephen Smith, and E. H. Janes, New York City, H. W. Dean, Rochester, N. Y., C. C. Cox, J. M. Toner, and John M. Woodworth, Washington, D. C., James E. Reeves, Wheeling, W. Va., H. O. Hitchcock, Kalamazoo, Mich., John H. Rauch, Chicago, Ill., Wm. Clendenin, Cincinnati, O., Thomas L. Neal, Dayton, O., C. B. White, New Orleans, La., James Johnson, Milwaukee, Wis., and J. J. Woodward, U. S. A.

FIRST DAY. — Dr. E. H. Janes, N. Y., Secretary *pro tem.*, read letters, accepting their election to membership, from President White, of the Cornell University, Drs. Jarvis, Mass., J. R. Cabell, Va., C. R. Agnew, N. Y., F. P. Porcher, Charleston, S. C.

An introductory address was read by the President (Dr. Snow, V. P., in the chair), on "The Limitations and Modifying Conditions of Human Longevity as the Basis of the Practical Application of Sanitary Knowledge."

The following papers, reports, etc., were presented for discussion: —

"Quarantine, and the Importance of Uniformity of Quarantine Laws in different States and Countries," by William J. Wragg, Charleston, S. C.

A "Statistical Report of the Boards of Health of different Cities, their Modes of Adminstration, etc.," by Dr. J. M. Toner, Washington, D. C.

A "Report on a Uniform System of Registration of Diseases and the Causes of Death," by Dr. C. P. Russell, N. Y.

Afternoon Session. — The Association met in the Lecture Room of the Bar Association, and an invitation to visit the rooms of the Young Men's Christian Association having been read and accepted, — Dr. C. C. Cox read a report on "the Necessity of a National Sanitary Bureau."

After some discussion, the following resolutions were adopted: —

Resolved, That in the judgment of this Association, the establishment of a National Sanitary Bureau, with relations to the general government similar to those of the Bureaus of Agriculture and Education, is highly desirable as a means of promoting sanitary science and the protection of the public health.

Resolved, That in our opinion it is of the utmost importance that a common nomenclature and classification be adopted for the purpose of the registration of deaths and diseases, and especially by all English-speaking peoples.

Resolved, That we regard the nomenclature and classification of diseases proposed by the College of Physicians of London, which has been extensively adopted in Great Britain and the United States, as more likely to be generally adopted for these purposes, than any other system yet proposed, and that we hereby recommend its provisional adoption in the United States.

Drs. J. J. Woodward, U. S. A., Edward Jarvis, Mass., and E. M. Snow, R. I., having been appointed a committee to communicate the foregoing resolutions to Dr. Sibson of London, and to negotiate for the representation of the Association in the first decennial revision of the nomenclature, the following resolutions were presented: —

Resolved, That the American Public Health Association deems it opportune that an international medical congress be requested to assemble during the American Centennial of 1876 in Philadelphia, to consider and adopt a nomenclature and uniform classification of diseases in the registration of diseases and deaths throughout the world.

Resolved, That the Committee on Registration be requested to prepare and present to this Association a blank for uniform weekly and monthly reports of mortality in our cities.

Resolved, That Boards of Health be requested to make out their reports on vital statistics for the period beginning in January and ending in December, and not for any fiscal or municipal year.

The reading of Dr. Jarvis's paper on "The Effects of Public Calamities in Diminishing the Number of Births," and a report on "The Recent Epizoötic," by Dr. A. B. Judson, of the Health Department, N. Y., closed the day's proceedings.

SECOND DAY. — Dr. Stephen Smith in the chair.

The Treasurer's report of the receipt of annual dues to the amount of $131, having been audited and approved, was adopted. The President having suggested the consideration of the publication of the Transactions, a special committee, consisting of Drs. Toner, Jarvis, and Bell, was appointed to consider the subject. An invitation to visit the House of Refuge having been read and accepted, it was voted that the Executive Committee arrange for the next meeting of the Association, and further appoint one or more commissioners to represent it at the International Statistical Congress. The President then read a report by Dr. Elisha Harris of New York, on "Areas of Sanitary Administration and the Practical Application of General Laws and Local Ordinances relating to the Public Health," — and the following resolution was adopted: —

Resolved, That a committee consisting of Dr. Elisha Harris, Dorman B. Eaton, Esq., LL. D., Dr. John Ordronaux, and Dr. Stephen Smith, be appointed to consider and report at the next meeting on the best plan for the appointment and organization of national, State, and local boards of health, and that the discussion of this report be made a special order of business, "and that this committee have power to fill vacancies."

Dr. Clendenin read a paper on "The General Causes of Disease," which was followed by a preliminary "Report on Quarantine and the Official Method of Sanitary Control of Contagious and Infectious Diseases," by Dr. Henry Hartshorne, Pa. The Association then adjourned, to visit by invitation the Cincinnati Hospital; and on reassembling the Secretary read a paper on "Quarantine," by Dr. Marsden of Quebec, as an opening for a discussion which followed on Dr. Hartshorne's report; the report was referred to a committee.

The President announced the reception of a telegram from his honor the Mayor of Providence, R. I., inviting the Association to hold its next meeting in that city. The invitation was accepted, and subsequently it was resolved that the Association should meet at Providence, R. I., on the second Wednesday in September, 1873.

The session concluded with the reading of a report by Dr. Rauch on "The Sanitary Drainage of Towns and Cities," and "Practical Lessons drawn from the recent Prevalence of Small-pox, with Reference to its Prevention in the Future," by Dr. Janes, N. Y.

THIRD DAY. — A communication was read from Dr. Charles A. Leas, Baltimore, asking that a committee be appointed to report on the best mode of utilizing sewage and other town refuse.

It was voted that the subject of forming committees be referred to the Executive Committee, and that subjects for investigation and report, be selected as nearly as possible in accordance with the wishes of the several members.

The following resolutions were then adopted: —

Resolved, That all reports and papers presented to this Association thereby become the property of the same.

Resolved, That all reports and papers be referred to the Executive Committee with power to publish so much thereof, and in such form as, in the judgment of said committee, will be most promotive of the objects of the Association; but the publication of a paper shall not be regarded as committing the Association to the opinions expressed by the author.

It was also voted that it is the sense of this Association that its papers should be published in a separate pamphlet form under the title of "Transactions of the American Public Health Association."

Dr. Toner presented the following preamble and resolution, which were adopted: —

Whereas it is important that boards of health of cities should at all times have as definite information as to the number, condition, and distribution of their population as practicable; and whereas it has been found practicable in other countries to collect such information, approximating correctness, through the aid of circulars properly prepared and distributed, which mode is attended with but little if any cost, and can be performed by the ordinary force of the various boards of health; therefore be it *Resolved*, That local boards of health be recommended, whenever practicable, to take a census of their population annually, on the 1st of January, by the instantaneous mode, that is, through the aid of circulars with blank inquiries upon all points of special interest to vital statistics and sanitary conditions, these blanks to be previously distributed to each family and housekeeper within the city, to be filled up by them at a fixed hour on the same day, the same to be called for on the following day by officers of the Board of Health, or by the police of the city, or by any other method that may be desirable.

An address on "The Homes of the American People; where and what they will be, as determined by Physical and Sanitary Influences," was then given by Professor Newberry, to whom the thanks of the Association were tendered for his able and elaborate treatment of the subject.

The thanks of the Association were also voted to the trustees and medical and surgical staff of the Cincinnati Hospital for their courteous attention; to Dr. Murphy, of Cincinnati, for his hearty reception and graceful entertainment of the members; to the daily press for its full and careful notices; to the Cincinnati Law School for the use of its hall; and to

Dr. Clendenin, Health Officer of Cincinnati, for his uniform and polite attention to the comfort and convenience of the Association.

A vote of thanks having been tendered to the officers of the Association for the manner in which their duties had been discharged, and the minutes having been read and approved, the Association adjourned to meet at Providence, R. I., in the following September.

ANNUAL MEETING IN NEW YORK, NOVEMBER 11–14, 1873.

The Association convened in the hall of the Union League Club, November 11. The meeting was called to order at 12 o'clock, by the President, Dr. Stephen Smith, N. Y., the following gentlemen being present: E. M. Snow, M. D., Rhode Island; J. M. Toner, M. D., D. C.; C. B. White, M. D., La.; H. B. Baker, M. D., Mich.; Prof. C. F. Chandler, M. D., and S. O. Vanderpoel, M. D., N. Y.; Edward Jarvis, M. D., Mass.; Lorin Blodgett, Esq., Pa.; H. G. Jones, M. D., Ind.; Hon. Jackson S. Schultz, N. Y.; J. J. Woodward, M. D., Ely McClellan, M. D., B. E. Fryer, M. D., John Moore, M. D., and J. S. Billings, M. D., Surgeons, U. S. A.; Hon. D. B. Eaton, N. Y.; J. H. Van Deman, M. D., Tenn.; Gen. F. A. Walker, Yale College, Conn.; Drs. Henderson and Williams, Medical Directors, U. S. N.; A. C. Hamlin, M. D., Me.; Moreau Morris, M. D., Charles P. Russell, M. D., John O. Stone, M. D., E. H. Janes, M. D., and Elisha Harris, M. D., N. Y., and many other physicians and citizens.

The President formally opened the conference by an "Address on General Sanitary Requirements, and the Purpose and Objects of the Association." The following reports upon Physical, Educational, and Social Conditions relating to Hygiene were then read: —

A Paper upon "Perfection of Structure and Function in the Human Body," by Nathan Allen, M. D., Mass.

A Report upon "The Power of the Housekeeper over, and Responsibility for, the Health of the Family," by Edward Jarvis, M. D., Mass.

A Report upon "Physical and Moral Causes of Bad Health in American Women," by James E. Reeves, M. D., W. Va.

In the evening, Edwin M. Snow, M. D., V. P., presiding, a presentation of a summary of evidence and local reports upon cholera, as it has prevailed in the Mississippi Valley and elsewhere in America during 1873, was made, and the subject was discussed at length, and illustrated and explained by means of charts and maps, by members from various localities.

Addresses were made and papers read by the following gentlemen: —

C. B. White, M. D., President Louisiana Board of Health, on "Cholera as it prevailed in that State."

Ely McClellan, M. D., Surgeon U. S. Army, "On Cholera in Twenty-three Counties in Kentucky."

J. H. Rauch, M. D., "On that Disease as it prevailed at Chicago, Ill."

J. H. Van Deman, M. D., "On Cholera at Chattanooga, Tenn."

Statements were also made by Drs. John C. Peters and A. B. Judson, New York.

Second Day. — The Treasurer's financial report was referred to an auditing committee, and a list of proposed members was read and approved. The roll of members being called, it was found that the constitutional quorum of twenty-five were not present, and the same difficulty having occurred at all previous meetings since the organization of the Association, — on motion of Dr. Woodward, U. S. A., the Association was dissolved, and adjourned *sine die*. It was then —

Resolved, That the members present of the late Association proceed to form an organization to be called the "American Public Health Association."

Dr. Stephen Smith, of New York, was elected temporary chairman; Dr. Elisha Harris acting as Secretary, *pro tem.* Dr. Woodward moved that a committee of five be appointed by the Chair to draft and report a form of Constitution for the consideration of the members.

The Chair appointed as such committee the following named gentlemen, namely: Dr.

Janvier Woodward, Surgeon U. S. A., Dr. Elisha Harris, New York, Dr. C. B. White, New Orleans, La., Dr. James E. Reeves, Wheeling, W. Va., Dr. A. C. Hamlin, Bangor, Me., who retired for conference.

Amendments of original Constitution are shown in the clauses of the Articles here numbered, new words introduced being in *italics*: —

SECTION IV. . . . . *All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.*

VIII. . . . . All Committees, and all members preparing scientific reports or papers to be laid before the Association, at its annual meetings, must give, in writing, the title *of such reports or papers, the time to be occupied in reading them, and an abstract of their contents*, to the Executive Committee, at least six weeks preceding the date of such meeting, to secure their announcement in the order of business.

X. . . . . There shall be no election of officers, or change of By-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular to all the members, together with the order of business.

XI. . . . . At the annual meeting *nine* members shall constitute a quorum for the election of officers, a change of the Constitution, the election of members, and the appropriation of moneys.

The special committee on constitution submitted a draft of a Constitution for the action of the gentlemen present. It was —

Resolved, That the draft of the Constitution as presented by the special committee thereon, be read by sections and acted upon.

Each and every section of the Constitution presented by the special committee having been severally read and adopted, on motion of Dr. Jarvis, of Massachusetts, the same was adopted as a *whole*, as the Constitution of the American Public Health Association. It was

Resolved, That this Association assume all pecuniary liabilities of the late American Public Health Association, and that its Treasurer turn over such funds and papers as may be in his possession, belonging thereto, to the Treasurer (when elected) of the present Association.

The following gentlemen were then elected officers of the Association: —

Dr. STEPHEN SMITH, N. Y., *President*.
Dr. E. M. SNOW, R. I., *First Vice-President*.
Dr. C. B. WHITE, La., *Second Vice-President*.
Dr. J. H. RAUCH, Ill., *Treasurer*.
Dr. E. HARRIS, N. Y., *Secretary*.

Elected members of Executive Committee: —

MOREAU MORRIS, M. D., New York.
EDWARD JARVIS, M. D., Massachusetts.
J. J. WOODWARD, M. D., United States Army.
S. O. VANDERPOEL, M. D., New York.
J. W. TONER, M. D., District Columbia.
A. N. BELL, M. D., New York.

The Executive Committee submitted a report, recommending that the members of the late Association, not present, be hereby declared elected members of the American Public Health Association; that the list of nominations for membership presented by the late Executive Committee of the late Association being approved by the present Executive Committee is respectfully submitted for election; and that the remaining portions of the programme, as furnished by the late Executive Committee, be adopted by the present committee; all which recommendations were unanimously adopted. A list of gentlemen was elected to be members of the American Public Health Association. (See *Official Catalogue and its dates.*)

It was then *Resolved*, That this Association strongly approves of the action of the Surgeon General of the army in attempting to establish a great medical library, and that the work which, under his direction, has thus far been accomplished in this respect, is of such magnitude and character, as to deserve the thanks of the medical profession of this country; and further, —

Resolved, That in view of the importance of making the files of the said library complete in periodicals, State and municipal reports, and transactions connected with medicine and hygiene, the special attention of physicians charged with the preparation or distribution

of such reports, et cetera, is invited to the importance of preserving, at least, one copy of every such document for the files in the said library.

Resolved, That a copy of these resolutions be forwarded to the Surgeon General, with the request that he present the subject to the attention of Congress.

The Executive Committee then presented the following resolutions and recommendations, which were adopted : —

Resolved, That should cholera make its appearance in the coming season, the Executive Committee be authorized to investigate and collect all facts with reference to its propagation and prevention, in order that communities may be fully informed of the necessity of sanitary precautions :

Resolved, That the Executive Committee are hereby empowered to publish the papers read before this Association, or such portions of them as appear advisable, and to make a special assessment, not to exceed five dollars, from each member for that purpose, if found necessary :

Resolved, That the Secretary of the Association be directed to publish one thousand copies of the Constitution, and of the list of members, as soon after this meeting as possible.

It was decided that the next annual meeting should be held at Philadelphia on the second Tuesday of November, 1874.

Experience having shown the desirableness of such a course, it was then —

Resolved, That the Secretary be instructed to open correspondence with local health authorities of all parts of the United States, requesting information upon matters relating to the health of their respective localities, and offering to reply to any inquiries on similar subjects which may be made by them.

An abstract from a report "On Sanitary Relations and Health Principles of Architecture," by Carl Pfeiffer, Secretary of the American Institute of Architects, was then read by the Secretary. Gen. Francis A. Walker, Supt. U. S. Census, etc., and Professor of Political Economy, Yale College, New Haven, delivered an address, illustrated by charts, upon the "Relations of Race and Nationality to Mortality in the United States."

The following reports were also presented and read : Report upon "Alimentation considered in its Relations to the Progress and Prosperity of the Nation," by A. C. Hamlin, M. D., Me.

Paper upon "Atmospheric Electricity and Ozone, and their Relations to Health and Disease," by Geo. M. Beard, M. D.

Reports upon "Sanitary Care and Utilization of Refuse of Cities," by Dr. J. H. Rauch, Ill., and Dr. C. A. Leas, Md.

Prof. J. S. Newberry, of Columbia College, then delivered a discourse, illustrated by maps, upon the "Future Distribution and History of the Population of the United States as affected by Physical Geography."

A Report upon "Non-periodic Changes of Heat as an Element in Sanitary Climatology," illustrated by charts and diagrams, was presented and read by Lorin Blodgett, Esq., of Philadelphia, and after discussion was referred for publication.

The Secretary presented Reports from Boards of Health and Sanitary Authorities upon Malignant Cholera, as it has prevailed in the United States, during 1873, together with a translation of Prof. Max von Pettenkofer's official Report on "What to do against Cholera."

Dr. Austin Flint read a paper upon "Evidences of the Relations of Drinking Water to the Propagation or Localization of Typhoid Fever and other Diseases."

Prof. Charles F. Chandler then gave an illustrated discourse upon "The Sanitary Chemistry of Waters, and the Practical Methods of perfecting the Water-Supply of Towns and Cities."

Professor Chandler was requested to prepare and furnish in form a copy of his discourse for publication in the Transactions of the Association.

THIRD DAY. — President Stephen Smith in the chair.

A telegram having been read from John E. Addicks, M. D., Health Officer of Philadelphia, the following papers and reports were read and discussed : —

Report upon "Yellow Fever as it prevailed at New Orleans during the Present Year," by S. C. Russell, M. D., La.

Reports upon "Yellow Fever at Mobile, Ala., and Pensacola, Fla.," by Drs. J. T. Gilmore and J. H. Hickman.

Report upon "Yellow Fever at Memphis, Tenn.," by Dr. J. H. Erskine, M. D., Tenn.

Report upon the "Natural History and Habits of Yellow Fever," illustrated by maps, by J. M. Toner, M. D., D. C.

An address was then delivered by the Hon. Dorman B. Eaton, upon the "Scope of Sanitary Laws," and the following papers were read and discussed: —

Paper upon "Sanitary Organization in Villages and Rural Districts," by Ezra M. Hunt, M. D., N. J.

"The Organization and Work of the Board of Health and Vital Statistics of Richmond County," by Jas. J. O'Dee, M. D., S. I.

"Local and Domestic Sanitary Cure of Contagious and Infectious Diseases, etc.," by Dr. Henry Hartshorne.

Papers in respect to Quarantine Establishments: by Dr. R. Lebby, Health Officer of South Carolina, Dr. G. W. Peete, Health Officer of Galveston, Texas, and Dr. A. W. Perry, New Orleans, La.

In the evening, there were concluding addresses at Association Hall.

FOURTH DAY. The Association met at one o'clock, P. M., in the chambers of the Health and Police Departments, No. 301 Mott Street. The President, Dr. Stephen Smith, in the chair.

A communication inviting the Association to witness the operation of destroying the noxious gases generated in the process of rendering animal fats, was received from James Turner, Esq.; and a telegram was received from Hon. Lester L. Bond, Mayor of Chicago, cordially inviting the Association to meet in the City of Chicago.

Dr. Snively, of Pennsylvania, then read an interesting report upon "Cholera as it prevailed at Pittsburg;" and Mr. Elwyn Waller, E. M., School of Mines, Columbia College, read a very valuable report on "Disinfection and Disinfectants."

The Principles and Practice of Quarantine and its Management in the Port of New York, were then discussed in addresses and statements by Drs. S. O. Vanderpoel, Health Officer of the Port of New York, A. N. Bell, Commissioner of Quarantine, and Elisha Harris, of the New York Health Department.

Dr. John C. Peters, of New York, then read an address on "Cholera as it prevailed at Lancaster, Ky.;" and Dr. Quinn addressed the Association in respect to the subject of "Cholera at Cincinnati, Ohio."

The following resolution was then adopted: —

Resolved, That a committee, consisting of Dr. S. Oakley Vanderpoel, Health Officer of the Port of New York, and such other members (five in number) as the President may designate, report at the next session, the practice and principles which prevail at the quarantine establishment of New York, and such suggestions as the committee may give respecting quarantine regulations in maritime and river ports.

The Auditing Committee reported the Treasurer's annual statement correct, and correctly vouched.

The following preamble and resolutions were then adopted: —

Whereas there is a probability of the prevalence of cholera, and other epidemic diseases in various portions of our country, the ensuing year, and as the legislative bodies as well as sanitary authorities in the different States of the Union will have to deal with important questions relative to health regulations;

Resolved, That the Executive Committee of the Association is hereby instructed to communicate with the Governors of the different States, with as little delay as practicable, presenting the reasons for, and urging the importance of, efficient sanitary organization based upon suitable laws and authority for State and local boards of health.

Resolved, That Hon. Dorman B. Eaton, with two other members appointed by the President of this Association, be a committee requested to prepare an outline of such laws and suggestions as may assist in attaining the foregoing objects.

The following resolutions were also adopted : —

Resolved, That a committee be appointed to prepare a form for a law providing for the organization of a National Health Department, or proper central organization having relations to the government and to the people, relative to the interests of health and life, similar to those of the Department of Agriculture relative to the interests of agriculture, or of the Bureau of Education relative to the educational interests ; that this committee be instructed to coöperate with a similar committee or "section" of the American Medical Association ; that, when a plan for a law shall be perfected, said committee be authorized to memorialize Congress for the enactment of such a law ; and that the committee report whatever action it may have taken to this Association at its next meeting.

Resolved, That in the appointment of this committee, each State shall, so far as is practicable, be represented by a member of this Association ; that the Hon. Dorman B. Eaton, of New York, be the chairman, and that Elisha Harris, M. D., Secretary of this Association, be the secretary of the committee, the other members to be appointed by the President of the Association.

It was then *Voted*, that most hearty thanks are hereby tendered to the several distinguished citizens who have contributed to the objects of this sanitary conference by their carefully-prepared public discourses, and that the Secretary communicate this resolution to each of the following named gentlemen, and request copies of their respective discourses for publication in the Association's Transactions : F. A. P. Barnard, D. D., LL. D., President Columbia College ; Hon. Andrew D. White, LL. D., President Cornell University ; Gen. Francis A. Walker, Professor Political Economy, etc., Yale College ; Prof. Charles F. Chandler, M. D., President Health Department ; Prof. J. S. Newberry, LL. D., School of Mines, Columbia College ; Prof. John Ordronaux, LL. D., State Commissioner in Lunacy, etc. ; Hon. Dorman B. Eaton, Chairman, etc., Civil Service Reform ; Hon. James W. Beekman, President Society New York Hospital.

The thanks of the Association were voted to the New York members of the Executive Committee for the measures taken to make the meeting profitable and pleasant ; to the press for its faithful and ample reports of proceedings ; and to Professor and Mrs. Chandler for their agreeable social entertainment.

The Association then adjourned, to meet in Philadelphia on the 10th day of November, 1874.

ANNUAL MEETING IN PHILADELPHIA, NOVEMBER 10–13, 1874.

The Association convened in the hall of the College of Physicians, the following named officers being present : Dr. Stephen Smith, of New York, *President ;* Edwin M. Snow, M. D., of Rhode Island, *First Vice-President ;* Elisha Harris, M. D., of New York, *Secretary ;* John H. Rauch, M. D., of Illinois, *Treasurer ;* and J. M. Toner, M. D., of District of Columbia, Moreau Morris, M. D., of New York, J. J. Woodward, M. D., U. S. A., and A. N. Bell, M. D., of New York, of the *Executive Committee.*

The conference was formally opened by the President, Dr. Stephen Smith, of New York, by an address on "the Purposes and Objects of the Association, and the Results already accomplished by it."

The following reports and papers were then read : —

A Paper on "Excessive Infant Mortality, and the Means of its Prevention," by Prof. Henry Hartshorne, M. D., Penn.

A Paper upon the "Influence of Hereditary Defects upon the Health of the People, with Suggestions in regard to Prevention and Eradication," by J. R. Black, M. D., Ohio.

"The Health of Tenement Populations and the Sanitary Requirements of their Dwellings," by Edward H. Janes, M. D., N. Y.

A Report upon "The Death-Rate of each Sex in Michigan, and Comparison with Dr. Farr's Life Tables of 'Healthy Districts' of England," by H. B. Baker, M. D., Mich. Dr. Baker was requested to furnish to the Association for its future use, such diagrams and illustrations as he might be able to procure, bearing upon the subject of his paper.

Notes upon "Hospital Location and Construction," by J. S. Billings, M. D., Assistant Surgeon, U. S. A.

A Paper on "The Sanitary Relations of Hospitals," by William Pepper, M. D., Penn.

A Paper upon "Hospital Architecture and the Perfect Ventilation of Hospital Wards," by Carl Pfeiffer, Esq., N. Y.

By permission of the Association, Dr. J. L. LeConte, of Philadelphia, presented a voluntary contribution on the "Organization of Municipal Boards of Health."

A conference of sanitary officers here ensued upon Methods and Experience in the Public Health Service of cities.

In the evening, after some introductory remarks by Hon. Morton McMichael, who presided, a Paper upon the "Relations of Health and the Higher Culture," was read by Rev. Samuel Osgood, D. D., of New York; and a discourse was delivered by S. D. Gross, M. D., of Pa., "Upon the Factors of Disease and Death, after Injuries, Parturition, and Surgical Operations."

The thanks of the Association were tendered to these two gentlemen for their able and eloquent discourses.

SECOND DAY. — The President, Dr. Stephen Smith, in the chair. The following reports and papers were read: —

A Paper upon "Building Ground in its Relations to Health and Disease," by Ezra M. Hunt, M. D., of N. J.

A Report upon the "Gathering, Packing, etc., and the Free Marketing of Vegetables and Fruits, etc., etc.," by S. C. Busey, M. D., of D. C.

The Conference then resolved itself into an Executive Session, and propositions for membership were presented and referred in each case, to the Executive Committee for investigation and report. It was next —

Resolved, That on the first of each year, the Executive Committee shall drop from the roll of members all persons who shall have failed to pay their dues for two consecutive years, and that it shall be the duty of the Treasurer to notify all persons in arrears of the existence of this rule.

The Executive Committee presented the following resolution, which was unanimously adopted: —

Resolved, That the volume of Transactions now in press, containing the Papers contributed during 1873, shall be issued, one copy each, to those members of the Association who shall have paid their dues for that year, and that, hereafter, the annual volumes of Transactions be issued to those members only who have paid their dues for the year to which the volume refers; but any member may obtain additional copies on the same terms as other subscribers.

Invitations were received from Thomas S. Kirkbride, M. D., to visit the Pennsylvania Hospital for the Insane, and from Abraham S. Wolf, Esq., President, to visit the Jewish Hospital. The Secretary was requested to communicate the thanks of the Association to each gentleman respectively for his courtesy.

The Treasurer submitted his Annual Report for the year 1873–74, which was referred to an auditing committee.

The following papers were then presented: —

A Report upon "The Sanitary Government, Vital Statistics, and the Methods of Public Health Administration in the Cities and large Towns of North America," by E. Harris, M. D., N. Y.

A Paper upon "Conditions and Accidents which endanger, limit, or prevent Vaccination from giving full Protection against Small-pox," by J. M. Toner, M. D., D. C.

A Paper upon the question: "Does Small-pox become Epidemic, etc.?" by E. M. Snow, M. D., R. I.

A conference upon Hospital Construction and Administration was then inaugurated, which closed at 5 P. M., when the following papers were read: —

A Report upon "Yellow Fever in the Dry Tortugas," by Harvey E. Brown, M. D., U. S. A.

Notes upon "The Causation of Scarlatina, etc.," by Dr. C. F. Rodenstein, of N. Y., and Report upon "Treatment of Gases from Rendering Tanks, etc.," by Dr. B. C. Miller, of Ill.

In the evening, after a few remarks by the chairman, Prof. W. S. W. Ruschenberger M. D., Pa., the following discourses were delivered : —

"Principles and Practice in Drainage and Sewerage in Connection with Water-Supplies," by Gen. E. L. Vielé, C. E.

"Certain Relations of Geology to the Water-Supplies of the Country," by Prof. Edward Orton, Ohio.

The thanks of the Association were voted to these two gentlemen for their excellent contributions.

THIRD DAY. — The President, S. Smith, M. D., in the chair. Dr. H. B. Baker, of Mich., presented to the Association from the State Board of Health of Michigan, a folio volume made up of samples of poisonous wall papers, and the following resolution was adopted : —

Resolved, That the Executive Committee be instructed to consider the subject of poisonous compounds, and report what action, if any, may be necessary for this Association to take in respect thereto.

Communications were received from B. C. Miller, M. D., Ill., inviting the Association to hold its next annual meeting at the city of Chicago, and from Dr. Francis Bacon, Conn., containing similar invitation to New Haven, Conn.

The Association then proceeded to the consideration of Reports and Papers (Dr. E. M. Snow, R. I., in the chair), namely: —

Paper upon "Reciprocal Relations to the Public Health Service and the Highest Educational Qualifications of the Medical Profession," by the President, Dr. Stephen Smith, N. Y.

A Paper upon "Syphilis in its Relations to the Public Health," by Frederick R. Sturgis, M. D., N. Y.

A Paper upon "Hay Fever, or Summer Catarrh," by George M. Beard., M. D., N. Y.

A Paper upon "The Introduction and Spread of Infectious Diseases," by John C. Peters, M. D., N. Y.

A Paper upon "Suicide in large Cities, etc.," by A. McL. Hamilton, M. D., N. Y.

A Paper upon the "Influence of the High Altitudes, etc., of the Table Lands of the Rocky Mountains upon Health and Disease," by B. E. Fryer, M. D., U. S. A.

Abstract of Special Reports by Army Medical Officers on "The Effect of Mountain Climates on Health," by J. S. Billings, M. D., U. S. A.

"Certain Perils of the School-Room," etc., by A. N. Bell, M. D., N. Y.

(The Secretary announced that persons desirous of listening to discussion upon Health in School-Rooms could do so by adjourning to an adjoining Committee Room.)

Dr. D. F. Lincoln, of Boston, Mass., offered some remarks in respect to the Medical Branch of the Social Science Association of Boston, and read a list of subjects proposed to be discussed at an intended meeting to be held, possibly at Detroit, Mich.

The Association here resolved itself into a conference upon Methods, Experience, and Improvements in the Public Health Service, and the following subjects were discussed : —

"Fœcal Poisoning of the Air," by Dr. B. A. Segur, Brooklyn, N. Y.

"Water Closets," by Dr. J. S. Steuart, Md.

Dr. Segur presented the following resolution : "That Water Closets should, under all conditions, take the place of sewer connected vaults."

"Sewerage and Drainage," by Dr. C. C. Cox, D. C.

"Night Soil and Cleaning of Privy Vaults," by Dr. B. C. Miller, Ill.

"Water Closets," by Dr. J. H. Rauch, Ill.

"Water Closets," by Dr. Jos. C. Hutchison, N. Y.

The following resolution was then adopted : —

Resolved, That a committee of three, of which General Vielé shall be chairman, be appointed to examine into and report upon the sanitary relations of pavements to cities, and the principles required to be fulfilled in a proper kind of pavement.

In the evening, the Association assembled at Horticultural Hall.

After a few preliminary remarks by the Chairman, Hon. Joseph R. Chandler, of Pa.,

a discourse, "Health Laws, and the Interests and Obligations of the State and National Governments pertaining to them," was delivered by Dorman B. Eaton, Esq., N. Y.

Hon. L. H. Steiner, M. D., of Md., read a paper upon "Health a Prerequisite of National Success in Peace and in War," followed by Rev. Dr. Bedel and Dr. D. Hayes Agnew, who delivered brief discourses.

The thanks of the Association were tendered to Dorman B. Eaton, Esq., and Hon. Lewis H. Steiner, M. D., for their discourses.

FOURTH DAY. The Association met at the Hall of the College of Physicians.

The President, Stephen Smith, in the chair.

The Executive Committee presented a list of names of gentlemen who were duly elected members of the Association. (See Official Catalogue.)

It was then *Resolved*, that a Committee of four be and the same is hereby appointed for the purpose of investigating and reporting on the extent to which poisons are used, in an unsafe manner, for agricultural and other purposes, and to recommend suitable regulations and restrictions with regard to the same, which was adopted, and the President appointed as such committee, S. Weir Mitchell, M. D., Pa., J. H. Rauch, M. D., Ill., J. L. LeConte, M. D., Pa., R. C. Kedzie, M. D., Mich.

Resolved, That a committee be, and hereby is, appointed to prepare schedules for the purpose of collecting information with regard to the present condition of public hygiene in the principal towns and cities of the United States, and the laws and regulations, State and municipal, relating to the same, and to report at the next annual meeting.

The committee consisted of J. S. Billings, M. D., U. S. A., *Chairman;* Elisha Harris, M. D., New York; J. M, Toner, M. D., Washington, D. C.; A. N. Bell, M. D., of Brooklyn; H. B. Baker, M. D., of Michigan; Ezra M. Hunt, M. D., of New Jersey; S. C. Busey, of Washington, D. C.; B. C. Fryer, M. D., U. S. A.; Frank Reilly, M. D., Marine Hospital Service; John L. LeConte, M. D., of Philadelphia; Edward Shippen, M. D., United States Navy; C. B. White, M. D., of New Orleans; Edwin M. Snow, M. D., of Rhode Island; and Josiah Curtis, M. D., of District Columbia, and such other persons as the committee may, from time to time, deem expedient to associate with them.

Resolved, That the Secretary be directed by the Association annually to report, on the first day of the annual session, the results of correspondence and information relating to public health.

The Auditing Committee on the Treasurer's Annual Report, reported it correct and correctly vouched. A paper was then read upon "Pharmacy in its Sanitary Relations," by J. M. Maisch, M. D., Secretary of the American Pharmaceutical Association.

The Association then proceeded to the election of officers for the ensuing year. Dr. Stephen Smith was reëlected President, but declining to serve, Dr. J. M. Toner, D. C., was nominated for the office, and the list then stood as follows for 1875: —

Dr. J. M. TONER, D. C., *President*.
Dr. EDWIN M. SNOW, R. I., *1st Vice-President*.
Prof. H. HARTSHORNE, M. D., Pa., *2d Vice-President*.
Dr. J. H. RAUCH, Ill., *Treasurer*.

Elected Executive Committee — Drs. Stephen Smith, Moreau Morris, and A. N. Bell, of New York, J. J. Woodward, U. S. A., J. S. Billings, U. S. A., and J. S. Steuart, Maryland.

On motion of the Executive Committee, a special committee, consisting of Hon. L. H. Steiner, Md., Drs. J. M. Toner, D. C., E. M. Snow, R. I., and Josiah Curtis, D. C., was appointed to report on plans for establishing State Boards of Health.

The following resolutions were presented by Prof. Henry Hartshorne, M. D., of Pennsylvania, and adopted: —

Resolved, That, for a city, properly arranged and conducted abattoirs, subject to municipal regulation, are always preferable to a number of private slaughter-houses.

That the best practicable management of large abattoirs, with cattle and hog yards, cannot be depended upon, at all times, to prevent their drainage from contaminating water and the atmosphere in their vicinity.

Therefore, such establishments should be located as far as practicable from the centres of population, and, if possible, upon tide-water.

Dr. Samuel D. Gross, of Philadelphia, submitted the following preamble and resolutions: —

Whereas, it is the solemn duty of every civilized government to provide means for the safety, happiness, and preservation of the health and lives of its subjects; and,

Whereas, a large number of the diseases incident to the human race are induced by causes inherent in our modes of living, and by our want of knowledge of the laws of hygiene, therefore be it —

Resolved, That a committee, consisting of a member of this Association from each State and Territory of the Union, of which the President of the Association shall be chairman, be appointed to petition Congress, at its next session, to institute a Bureau of Health, to be located at Washington City, with a branch at the seat of each State and territorial government:

Resolved, That we hereby invite the earnest coöperation of the auxiliary branches of this Association, and of all kindred bodies in the Union, in carrying out the objects of the foregoing resolution.

Dr. H. Earnest Goodman submitted the following resolutions: —

"That this Association urge upon the Governor and Legislature of each and every State in the Union, the importance of enacting laws creating State Boards of Health, providing adequately for sanitary administration.

"That a copy of this resolution be forwarded to each Governor and Legislature, duly signed by the President and Secretary of the Public Health Association."

Voluntary contributions were presented by Drs. A. B. Judson, of New York, William Hunt, of Philadelphia, Heber Smith, United States Marine Hospital Service, and William S. Ludlum, of New York.

The minutes of the last annual meeting were adopted, and the reading thereof dispensed with, and the reading of the minutes of the present meeting was postponed until the next annual session.

It was then *Resolved,* That a committee be appointed to report to the meeting of the Association next year upon the sanitary and unhygienic condition of watering-places in this country. The president appointed Prof. H. Hartshorne, chairman, to organize such committee.

Dr. Stephen Smith, of New York, was requested to prepare a paper upon the subject of hospitals, and submit the same to the Executive Committee for publication in the transactions.

The following resolution was then adopted: —

Resolved, That the Secretary be, and is hereby, authorized to obtain from Boards of Health and sanitary authorities, in their respective localities, information in regard to the progress of sanitary work and public health interests, and prepare the same for publication in the annual volume, under the supervision of the Executive Committee.

On motion of Dr. E. Harris, of New York, the Executive Committee was empowered to call a special meeting of the Association during the coming spring, and to designate time and place, if deemed suitable.

The thanks of the Association were voted to the trustees of the hall of the College of Physicians of Philadelphia for the use of the hall; to committees and citizens of Philadelphia who so much appreciated and assisted to promote the objects of the organization, and to the daily press, especially the "New York Times," for their full and faithful reports of proceedings.

The Association then adjourned *sine die.*

THIRD ANNUAL MEETING, HELD AT BALTIMORE, NOVEMBER 9–12, 1875.

First Day. — The meeting was called to order by the President, J. M. Toner, M. D., at 10 o'clock A. M. The Secretary read the following list of members in attendance: J. M. Toner, M. D., Washington, D. C., President of the Association; Henry Hartshorne, M. D., Pennsylvania, Vice-President; J. H. Rauch, M. D., Illinois, Treasurer; Elisha Harris, M. D., New York, Secretary; Drs. C. B. White, New Orleans; A. N. Bell, Brooklyn; Ezra M. Hunt, New Jersey; J. W. Pinkham, New Jersey; Heber Smith, Surgeon Marine Hospital Service, New York; Frederick Brown, Boston; J. J. Woodward, United States Army; John M. Woodworth, Supervising Surgeon, United States Marine Hospital Ser-

vice; John S. Billings, Washington, D. C.; Stephen Smith, New York; J. A. Steuart, Baltimore; Moreau Morris, N. Y., W. Snively, Crosby Gray, Pittsburg, Penn.; Thomas L. Neal, Dayton, Ohio; L. H. Steiner, Frederick, Md.; R. S. Steuart, President Maryland Hospital; H. R. Noel, L. C. Winternilz, J. S. Conrad, D. I. McKew, E. Lloyd Howard, C. W. Chancellor, Baltimore; Richard J. Dunglison, Philadelphia; Wm. Lee, Washington, D. C.; Robert T. MacCoun, United States Navy; H. O. Hitchcock, President State Board of Health, Kalamazoo, Mich.; James E. Reeves, Wheeling, W. Va.; F. Donaldson, Baltimore; C. H. Nichols, John Eaton, Washington, D. C.

ADDRESSES AND PAPERS.

Dr. James A. Steuart, Health Commissioner of Baltimore, and Chairman of the Committee of Arrangements, read an address of welcome to the Association, followed by an Introductory Address by Joseph M. Toner, M. D., President of the Association; a paper on "Dwelling-houses in their Relations to Health," by Ezra M. Hunt, M. D., of New Jersey; and a "Preliminary report on the Sanitary Condition of American Watering Places," by Prof. Henry Hartshorne, M. D., University of Pennsylvania.

At the conclusion of each of the latter papers, Drs. Harris, Hunt, and Hartshorne, joined in the discussion of them.

Meeting adjourned to 3.30 P. M.

TUESDAY AFTERNOON.

At 3.30 P. M. the session was resumed according to order of adjournment, Dr. J. M. Toner in the chair. The afternoon's proceedings opened with the reading of the Report by the Secretary of the Association, on the information obtained concerning the Public Health, and the Progress of Sanitary Works in the cities of our country the past year. A discussion then followed: —

First. What public necessities require that there shall be a Central or State Board of Health in each State, and with what authority and duties should the State Board of Health be endowed?

Second. How shall local and State Boards of Health effectually supervise the Registration of Vital Statistics, especially as respects causes of death, and investigate the sources of preventable diseases, so as best to promote the public welfare?

Prof. E. Lloyd Howard, Secretary of the State Board of Health of Maryland, stated that their Board had just completed a survey of the condition of jails, almshouses, and other public buildings of the State, and for a better supply of water for Baltimore, of which a report was to be made to the next legislature.

After some discussion by Drs. Hunt and Hartshorne on the subject of "How best to extend Sanitary Information throughout the Country," papers were read by Prof. E. Lloyd Howard, M. D., Secretary of the State Board of Health of Maryland, on "Legislation upon Sanitary Matters," and by Franklin B. Hough, M. D., on "Public Health Interests concerned in the Preservation of certain Primeval Forests, and in the Cultivation of Groves and Trees."

Adjourned to meet at 8 o'clock P. M.

In the evening, the Hon. Ferdinand C. Latrobe, Mayor of Baltimore, presiding, after an introductory address, and in the absence of D. C. Gilman, President of the Johns Hopkins University, whose illness prevented his presence, a discourse was read by Prof. Henry Coppeé, LL. D., of the Lehigh University, on "Health Subjectively Considered," followed by an address by Dorman B. Eaton, LL. D., Chairman of the United States Civil Service Commission, on "The Essential Conditions of Good Sanitary Administration." At the close of this address a letter was read from Archbishop Bayley, of Baltimore, to the Secretary of the Association, in reply to an invitation to be present and address the meeting, by Hon. Dr. Steiner.

Adjourned to 10 o'clock A. M., Wednesday, November 10.

SECOND DAY. — Dr. Toner, President, in the chair. The Secretary announced that the Executive Committee had recommended for membership the following persons, who were unanimously elected. (See Official Catalogue for 1875.)

The following resolution was submitted by the Executive Committee, and unanimously adopted: —

Resolved, That the election of officers and members of the Executive Committee be conducted in the same manner as at the Philadelphia meeting; namely, There will be no nominations, but in lieu thereof each member will write on a slip of paper his preference for each office, and the results of this informal ballot will be taken in lieu of nominations, after which each officer will be separately voted for by ballot, and the Executive Committee will be voted for on a single ballot. If, on a ballot for the Executive Committee, any nominee shall receive a majority of the votes, he will be declared elected, and subsequent ballots will be for the remaining places only.

The Treasurer, Dr. Rauch, offered his official report, which was referred to a Finance Committee to be appointed by the President.

After the reading of the report of the committee on "A Plan for the Systematic Sanitary Survey of the United States: with introductory remarks on Medical Topography," by John S. Billings, M. D., of Washington, Chairman of the Committee, —

Dr. S. C. Busey of Washington offered the following resolutions, which were adopted, being seconded by Dr. E. Harris: —

Resolved, That the report of Dr. Billings be referred to the Executive Committee with instructions to appoint a special committee, whose duty it shall be to carry into effect the plan for a systematic sanitary survey of the United States.

Resolved secondly: That the Executive Committee shall request the Surgeon General of the United States Army to detail a medical officer of the army, who under the direction of the Surgeon General of the United States Army, shall coöperate with said special committee in the prosecution of the duties of the committee.

The following Papers were then read: —

"A Report on the Drowned Lands of Orange County, N. Y., and Sussex County, N. J., and the Sanitary and Economic Importance of Drainage for them," by Prof. George H. Cook, State Geologist of New Jersey.

"Soil Drainage and Atmospheric Humidity, considered with Reference to their Influence upon Health and Disease," by Sandford B. Hunt, M. D., N. J.

"The Necessity for and Selection of Summer Resorts for the different classes of People," by W. C. Van Bibber, M. D., Baltimore.

A Report on "The Use of Poisons in Agriculture and Horticulture, and Tests of their Effects on Food-Vegetables," by Prof. R. C. Kedzie, M. D., Agricultural College, Mich.

The meeting then adjourned to 3.30 o'clock P. M.

In the afternoon, Dr. Toner, president, in the chair,

The following Papers were read: —

A Report on "Drainage, Sewerage, and Water-Supplies of Cities," by Gen. Egbert L. Vielé, C. E., N. Y.

"School Hygiene," by D. F. Lincoln, M. D., Boston, Mass.

"The Sanitary Relations of Drainage and Water-Supply in North Carolina and the South Atlantic States, as affected by Topographical and Geological Conditions," by Prof. W. C. Kerr, State Geologist of North Carolina.

"Nervous Disease among School Children, with Suggestions for its Prevention," by Allan McLane Hamilton, M. D., New York City.

"Sewer-Gas as a Cause of Diphtheria, Membranous Croup, and Typho-Malarial Diseases," by Prof. H. R. Noel, M. D., Baltimore.

"School-Room Stunting," by A. N. Bell, M. D., Brooklyn, N. Y.

The meeting then adjourned to 8 o'clock P. M.

At the evening session Hon. Joshua Vansant, Ex-Mayor of Baltimore, presiding; the following addresses were delivered: —

By Prof. Stephen Smith, M. D., on "The Application of Sanitary Principles to the Limitation of Perilous Massing of Populations in our Cities."

By Prof. F. Donaldson, M. D., on "The Influence of City Life and Occupations in developing Pulmonary Consumption."

THIRD DAY. — Dr. Toner, President, in the chair.

A list of members was read, who were duly elected; and after the Secretary had read the resolution accepted in Philadelphia governing the manner of election, the Association proceeded to the election of officers. During the counting of the informal ballots the Secretary read letters from absent members, and a communication from the Secretary of the Association of Health Officers of the Lower Rhine (Köln), requesting to be put in full fellowship with the American Public Health Association, for the mutual interchange of publications.

Dr. Harris presented from Mr. Ross Winans of Baltimore, three monographs on the following subjects: "Baltimore Harbor Nuisance," "Ventilation of Dwellings," "Hygiene and Sanitary Matters." On motion of Dr. Harris,

Resolved, That a vote of thanks be tendered to Ross Winans, Esq., for the volumes presented, and that the same be placed in the library of the Association.

The following list of officers of the Association was elected, in accordance with the rules established by the Constitution and agreed upon at the present and the preceding annual meeting: —

President — EDWIN M. SNOW, M. D., Providence, R. I.

1st Vice-President — JOHN H. RAUCH, M. D., Chicago, Ill.

2d Vice-President — FRANCIS A. WALKER, LL.D., New Haven, Conn.

Treasurer — J. FOSTER JENKINS, M, D., Yonkers, N. Y.

Secretary. — The term of the Secretary's office continuing three years, does not become vacant until the autumn of 1876.

ELECTED MEMBERS OF EXECUTIVE COMMITTEE.

DR. JOHN S. BILLINGS, U. S. A.
DR. EZRA M. HUNT, N. J.
DR. JOHN M. WOODWORTH, D. C.
HON. DR. L. H. STEINER, Md.
JACKSON S. SCHULTZ, New York.
HON. ALONZO W. BOARDMAN, Mass.

The Secretary announced that invitations from Savannah, Boston, Detroit, Providence, and Philadelphia, to hold the next annual meeting at those places, had been received.

An invitation from John T. Morris, President of Public Schools of Baltimore, having been read, inviting the members of the Convention to visit the school-buildings in the city, was accepted.

The Secretary read the following communication from the Centennial Medical Commission, Philadelphia: —

To the President American Public Health Association.

DEAR SIR, — On behalf of the Committee of Arrangements of this body, I am directed to ask that the American Public Health Association will appoint ten delegates to represent said Association at the session of the International Medical Congress, to be held in this city September 4 to 9, 1876.

Very truly your friend,

(Signed) WM. B. ATKINSON, Secretary, etc.

PHILADELPHIA, *November* 9, 1875.

The invitation was accepted, and the following gentlemen were appointed by the President as delegates: —

DR. JOSEPH M. TONER, Washington.
DR. C. F. FOLSOM, Boston.
DR. J. S. BILLINGS, Washington.
DR. STEPHEN SMITH, New York.
DR. C. B. WHITE, New Orleans.
DR. J. G. THOMAS, Savannah.
PROF. R. C. KEDZIE, Lansing, Mich.
DR. JAMES A. STEUART, Baltimore.
DR. THOMAS M. LOGAN, Secretary State Board of Health, Sacramento, Cal.
DR. HENRY A. JOHNSON, Chicago.

The following resolution was adopted: —

Resolved, That the Treasurer is authorized to use the funds in his hands which pertain to the Philadelphia meeting (year 1874) to meet the engagements he has made with regard to the publication of Volume II. of the Papers and Transactions, and that all dues belonging to that year which may hereafter be collected shall be applied to the same purpose.

The following notice was announced: —

Proposed Amendments to the Constitution. — In Article III., line 4, after the words "shall be," read "active or honorary, and shall be." In the same article, after the last line, add "honorary members pay no fees." Proposed by J. J. Woodward.

In Article VIII., page 5, line 3, strike out the word "six" and insert "nine." Proposed by John H. Rauch.

Papers were then read as follows : —

Report on "Efficient House Connections with Sewers and the Protection of Houses against Sewer-Gases," by Frank Hambleton, C. E., of Baltimore, and a statement by Jackson S. Schultz, Esq., of New York, on the "Utilization of Animal and Vegetable Refuse Substances in our Large Cities."

Dr. Ezra M. Hunt opposed the feeding of hogs for food, as proposed in the latter paper. He considered the flesh unfit for consumption. There was no doubt that hogs would eat garbage and dead horses ; but who would eat the hogs? Hogs fed in that way were not like the hogs fed in the farmer's farmyard ; eating their flesh was like drinking the milk of swill-fed cows. He would turn Jew before he would eat that kind of pig.

Mr. Schultz replied that Dr. Hunt was eating that sort of swine-flesh, if he ate hog at all. A delegate inquired : Would not the locating of extensive hoggeries on the islands adjacent to New York produce evil effects from the exhalations? Mr. Schultz thought they could be so managed as to be inoffensive. The following papers were then read : —

A paper on "Penny Wisdom and Pound Folly, or the Cost of a Great Epidemic of Small-pox to a Great City," by Benjamin Lee, M. D., Philadelphia, and a report on "Principles and Methods of Ventilation," by Carl Pfeiffer, F. I. A., New York.

The latter paper gave rise to some remarks to the effect that it was the duty of the owners of tenement-houses to provide a ventilating apparatus which could not be tampered with by the occupants, who were in many cases ignorant of the value and necessity of fresh air.

A paper on "The Relations of the Excessive or Habitual Use of Alcoholic Drinks to Public Health and Public Welfare," by Homer O. Hitchcock, M. D., President of State Board of Health, Kalamazoo, Michigan, closed the session.

In the afternoon, papers on "Alcohol in relation to Life Insurance," by W. G. Harrison, Jr., M. D., Baltimore, and "Sanitary and Economical Advantages of Small Hospitals or Village Infirmaries for Manufacturing and Mining Populations," by Thomas J. Dunott, M. D., Harrisburg, Pa., having been read, Dr. G. M. Sternberg, Assistant Surgeon, U. S. A., Fort Barancas, Florida, by request of the Executive Committee, read a volunteer paper on "Yellow Fever, its History and Origin, at Pensacola, Florida, in July, 1875," followed by a paper on "Yellow Fever on Pensacola Bay, Florida, in 1875," by Harvey E. Brown, Assistant Surgeon, U. S. A., Fort Barancas, Florida.

Facts relating to diseases among the Indian tribes of North America, by Josiah Curtis, M. D., Supervising Medical Officer to the Indian Bureau, Washington, D. C., were given in an extempore address, followed by a volunteer paper on "Western North Carolina as a Health Resort," by Dr. William Gleitsmann of Asheville, North Carolina.

Evening Session. — The audience was the most numerous of all the sessions, and comprised many ladies. Discourses were delivered by Hon. L. H. Steiner, M. D., on "A Sanitary View of the Question, 'Am I my Brother's Keeper?'" followed by Andrew D. White, LL. D., on "Sundry Disputed Points regarding Sanitary Care and Physical Culture in our Universities, Colleges, and Larger Schools."

FOURTH DAY. — The meeting having been called to order by Dr. J. M. Toner, — the following gentlemen were proposed for membership. (See Official Catalogue.)

The following resolution was then adopted : —

Resolved, That the Executive Committee of this Association is hereby instructed to memorialize, in the name of this Association, the Congress of the United States in favor of such legislation as will bring about a proper coöperation between the General Government of the United States and the several State Governments, for a uniform and efficient system of the registry of the deaths, births, and marriages of the population.

The President then announced the following members for the Committee on a National Sanitary Survey : —

Dr. Elisha Harris, New York, Chairman ; Dr. E. M. Hunt, New Jersey ; Dr. H. B. Baker, Michigan ; Dr. John H. Rauch, Illinois ; Dr. S. C. Busey, Washington, D. C. ; Dr. James A. Steuart, Maryland ; Dr. C. B. White, Louisiana ; Dr. Thos. N. Logan, California ; Dr. J. S. Billings, U. S. Army, Dr. H. E. Brown, Surgeon U. S. Army, Dr. Joseph M. Toner, Washington, D. C. ; Dr. J. M. Woodworth, Washington, D. C. ; with power to add to their number.

The following resolution, offered by the Secretary, was adopted: —

Resolved, That in view of the fact that the funds of the Association are insufficient to publish in full all the papers presented, the President shall appoint two members, who, with the Secretary, shall constitute a publishing committee.

Resolved, That it shall be the duty of this committee to examine the papers presented to it by the Secretary, and to decide as to which shall be published in full, and which in abstract or by title only.

Dr. J. Foster Jenkins of Yonkers, N. Y., and Dr. B. A. Segur of Brooklyn, N. Y., were appointed to act with the Secretary as such committee.

Dr. A. N. Bell then offered the following resolutions in memoriam: —

Whereas it has pleased Almighty God to remove from us by death Ernst Krackowitzer, M. D., and G. W. Peete, M. D.,

Resolved, That in the causes of their death respectively, the former by typhoid fever contracted in the exercise of his duty as a physician, and the latter in the gallant exercise of his office in the midst of a terrific storm, they have intensified their endearments to us as most useful members, and left lasting memorials of blessed examples in the purposes of this Association.

Resolved, That copies of this preamble and these resolutions be sent to the families of the deceased as an evidence of our heartfelt sympathy in their and our loss.

Unanimously adopted.

The Secretary then reported that there had been thirty-four papers read, leaving thirteen papers to be read. As there was not sufficient time, these were then read by title, as follows: —

"Infant Mortality in the State of Michigan," by H. B. Baker, M. D., Secretary State Board of Health and Registrar of Vital Statistics of Michigan. Report on the "*Anthrax Epizoötic, and the communication of its Infection to man, in the Genesee Valley, N. Y., in* 1875," and a paper on "*Hereditary Entailments in the Domestic Animals and in the Human Family*," by Prof. James Law, M. D., D. V. S., Cornell University, N. Y. Report on "Eradication of Hereditary Defects" (supplementary to report commenced in 1874), and a paper on the "Sanitary Value of the Dry-Earth Treatment of Excremental Matters," by J. R. Black, M. D., of Ohio. On "Water-Filtration for Domestic Use," by Thad. M. Stevens, M. D., Indianapolis. On "The Special Causes which produce excessive Infant Mortality in Montreal, Canada," by J. J. Dugdale, M. D., Health Officer of Montreal. On "The Popularization of Sanitary Science in our Schools," by Prof. E. W. Claypole, Antioch College, O. On "The Organization and Service of Small-pox Hospitals, the Domestic Sanitary Seclusion and Transportation of Small-pox Patients," by Edward H. Janes, M. D., Assistant Sanitary Superintendent, New York. "Sanitary Principles in Home Architecture," by H. W. Dean, M. D., Rochester, N. Y. A report on "Laws, Sanitary Provisions, and Methods for securing the benefits of General Vaccination throughout the Country," by Elisha Harris, M. D., New York. "Moisture of Dwellings and Sick-Rooms considered in connection with that of Atmosphere," by Fred. Pettersen, M. D., Health Officer, San Antonio, Texas. A paper on "Ozone and its Effects upon Diseases of the Respiratory Organs," by Fred. Pettersen, M. D.

The following resolutions were then unanimously adopted: —

Resolved, That the thanks of the Association are hereby tendered to the Committee of Arrangements for the completeness and liberality of their provision for the meetings of the session.

Resolved, That the thanks of the Association are tendered to the medical profession and the public for their interest in the objects of the Association, and to the Reporters of the Daily Press for the accuracy and fullness of their reports.

The meeting adjourned at noon, to meet in Boston in the autumn of 1876.